TOY MAKING

A Practical Guide to the making of a number of Popular Toys

ILLUSTRATED BY 58 PHOTOGRAPHS AND 178 LINE DRAWINGS

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PREFACE

THIS book is offered to the public at an opportune time. It shows how to make a number of popular toys, and will be found a thoroughly practical guide by the amateur and small tradesman. While no book of this size can pretend to be a complete treatise on the subject, sufficient information is given here to assist the handyman in making toys in his spare time, and many persons desirous of setting up in the toy trade and helping to meet the German and Austrian competition will be glad to have the opportunity of perusing this work. Those it cannot teach it will at least provide with suggestions.

B. E. J.

La Belle Sauvage
London, E.C.4.

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TOY MAKING

CHAPTER I

Introduction

Toy Making is an ancient industry which, in its modern form, has become closely associated with certain countries and nationalities. Toys of the highest class as regards materials and solidity of construction have long been made in England, but the ordinary toys, selling at a low price, have been coming in constantly increasing quantities from the Continent—chiefly Germany, Austria, Switzerland and France—and in the two Germanic countries there are whole districts where one particular branch of toy making is the staple industry, and where, as is well known, every small house is a self-contained miniature factory, staffed by both parents and children. The industry is handed on from one generation to the next, a state of affairs which naturally results in a high degree of manual skill and in the possession of many small "trade secrets" which often render effective competition a matter of extreme difficulty to the outsider. Wood is the chief raw material used in toy-making, and as it happens that the centres of the foreign toy industry are generally to be found amid the forests, it follows that the outlay on material is small; which fact, added to the family system of working, the

low scale of remuneration, and government assistance on organised lines, goes to explain why German competition is so difficult to meet. Curiously, however, German and Austrian prices are not always lower than the British. In a case which came under our notice in the spring of 1914, the German quotation for heavy toy work in wood was appreciably higher than for British work of a superior kind.

A supply of cheap material is essential to the production of low-priced wooden toys, and the small tradesman seeking to enter the industry as a maker of the smaller articles would do well to assure himself in the first place of a supply of ends and other waste which he could turn to profitable account.

A number of amateurs have asked whether they can make money at toy-making in their spare time, and many small professional woodworkers also have asked whether they can profitably engage in the industry. It is difficult to answer "yes" or "no." So much depends upon the person, his skill, his opportunities, his business knowledge and methods, and the district in which he lives. Circumstances being favourable, the answer is "yes" if he restricts himself to well-made solid stuff, the obvious durability of which will at once be its own recommendation. But he cannot hope, as a rule, to compete with well-equipped factories in the production of the smaller repetition work, in the manufacture of which the possession of machine tools and the employment of cheap boy or girl labour is the only possible means of doing the work at a profit. There is no doubt that many firms in the woodworking trades are

succeeding in getting a hold on the toy-making industry, and the photograph (Fig. 1) shows the workshops of a firm of wagon builders at Motherwell, N.B., who after the outbreak of the European war started to make toys,

Fig. 1.—Toy Maker's Workshop.

and rapidly found the demand greater than they could supply.

A properly equipped toy-making workshop must include a light circular saw, worked by treadle or power (the American type being recommended); and there is no doubt that the possession of a bench drilling machine, treadle-driver, and of a sand or glass-papering machine would be a great advantage.

CHAPTER II

Wooden Cannon

As regards materials for making toys, it is sometimes recommended that old packing cases and such be made use of. With this idea the writer does not agree, as the work of pulling to pieces, removing the nails, and so on, takes time; and if profit is to be made out of the work,

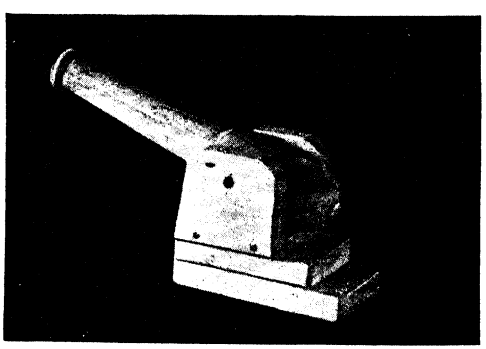


Fig. 2.—Mounted Wooden Cannon.

the time must be wholly occupied in doing the work, not partly in adapting waste wood. The better way is to buy a job lot of yellow pine or American whitewood, which may be picked up cheaply, and will work well and easily, causing no waste of time.

Figs. 2 and 3 show a cannon that is 5 in. long, and is turned up in the lathe. Before turning up, the holes to form the muzzle and also to take the bar on which the gun

swivels are made, as shown in Fig. 4, where three pieces of wood so prepared are shown. Fig. 5 shows the three turned up to shape, and one of them has the swivelling bar inserted.

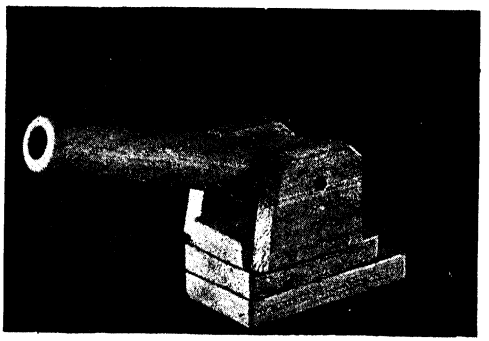


Fig. 3.—Another View of Mounted Gun.

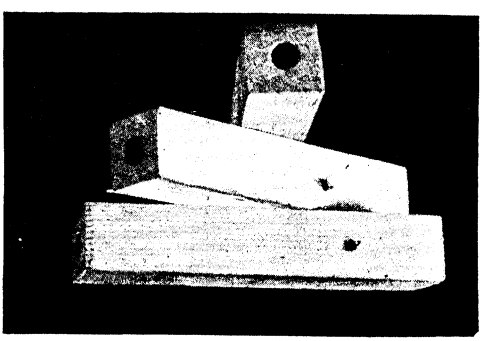


Fig. 4.—Wood Bored for Making Cannon.

The turning up of the gun is extremely simple, and several can be turned up in a few minutes. The muzzle forms the centre for the tailstock, and, of course, the breech end is fixed on the prong chuck in the usual way. (Readers ignorant of the methods of simple wood-turning cannot

do better than to send 1s. 5d. to the publishers of this book, with a request that parts 3 and 5 of "The Amateur Mechanic" be posted to them; these fully explain how to set about a simple job in wood-turning; work held in cup chucks is described in two later parts, 9 and 10.)

Fig. 5.—Turned Cannons.

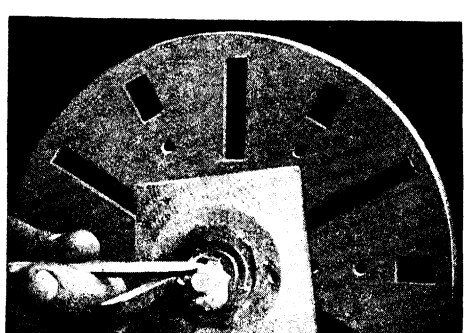


Fig. 6.—Turning Pivoting Bars.

The bar on which the gun is pivoted passes entirely through, projecting some $\frac{3}{8}$ in. at each side, and the best way to produce these quickly is to turn them. This is done by fixing a block on the faceplate or screw-chuck, turning a hole in the centre, and then by driving in a piece of wood tightly, the bar can be turned from it with a few

strokes of the turning tool. Fig. 6 shows this being done. There was a rough block on the faceplate, and this was utilised as a chuck to turn the bar in as shown.

The gun carriage is made up of five pieces of wood,

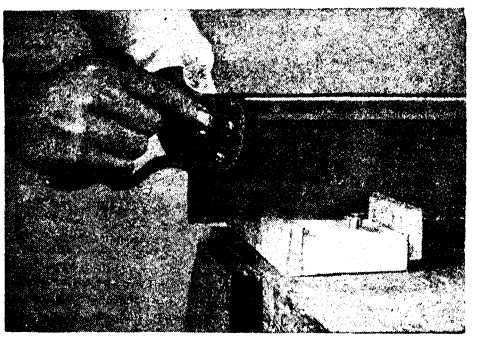


Fig. 7.—Cutting Wood to Size with Aid of Template.

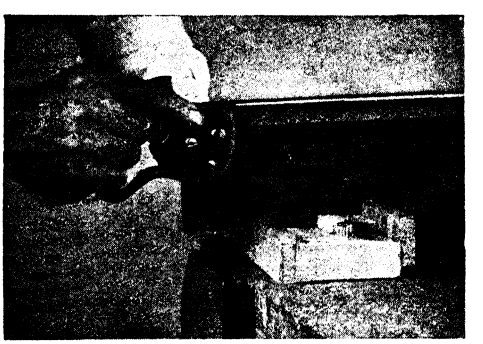


Fig. 8.—Cutting off Blocks to Form Gun Carriage.

as shown in Figs. 2 and 3, which are made by preparing a long piece to the proper size and cutting them off to the correct lengths; as marking off takes time, the necessity of any measuring or marking is avoided by making the

appliance shown in Fig. 7. This consists of a shallow trough, parallel in width, with a saw-cut across it at right angles. A screw or screws are inserted at intervals in the bottom of the trough, and by removing these as required for the length needed, any number of pieces can be obtained all of the same length. Fig. 8 shows one piece being cut off in the trough, and if a fine saw is used the ends will only need a slight rub on a piece of glasspaper to finish them.

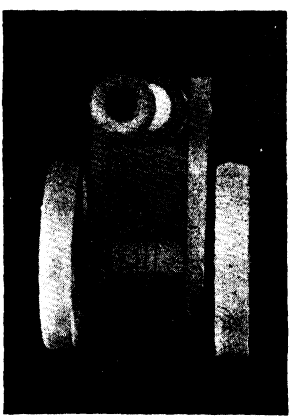
The parts of the gun carriage as shown are respectively 3 in., 2½ in., and 2 in. long, the two former being 1½ in. wide, the latter 1⅛ in. only. The two upright side pieces are 1¾ in. long at the bottom edge, tapering to 1½ in. at the top, and the width is 1½ in.; all the taper is at the front end as shown. These taper ends can be cut on the trough by making another cut at the correct angle.

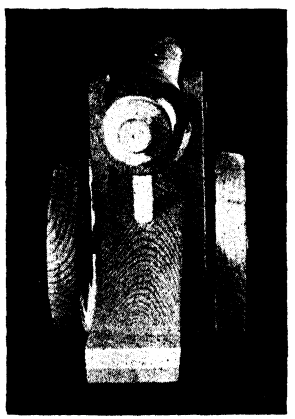
The gun as shown is unpainted. It is best painted a lead colour, the same as the real thing, and the best way to do this is to make up some rather thin paint and dip the guns in it, afterwards hanging them up to dry. A little cheap varnish added to the paint will make it dry smoothly; do not put too much, as a gloss is not wanted.

A Working Cannon.—A cannon that can be fired off will have more attraction for boys than one which is for show only, but, of course, it is quite impracticable to use gunpowder with a wooden gun. This being so, the cannon shown by Figs. 9 and 10 has been designed to be fired by means of a spring, the breech of the gun being pulled back to bring the spring into action.

The length of the gun illustrated is 12 in., and the

trail end of the carriage projecting a further 4 in. makes up a total length of 16 in. The gun at the breech end is $1\frac{1}{2}$ in. in diameter, continuing parallel for 4 in., the reduced part being $1\frac{1}{4}$ in. at its largest part, tapering to $\frac{7}{8}$ in. at the muzzle (not including the bead). The wheels are $4\frac{1}{2}$ in. high, and the connecting parts of the gun





Figs. 9 and 10.—A Working Toy Cannon.

carriage are 5 in. long by $1\frac{1}{2}$ in. wide. The actual gun carriage is 8 in. long by $1\frac{3}{4}$ in. wide.

The gun itself should be made first, and for convenience in boring it this is made in two separate pieces, and the longer or the front portion will be dealt with first. This should be made from a piece of wood 9 in. long by $1\frac{1}{2}$ in. in diameter ; and before turning up, a hole $\frac{1}{2}$ in. in diameter must be bored through it from end to end, and as it is absolutely necessary that this hole be straight, it must be bored from one end only. Therefore, if the maker does

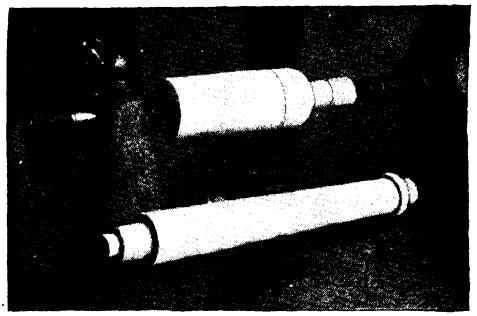


Fig. 11.—Breech and Barrel of Cannon Turned to Shape.

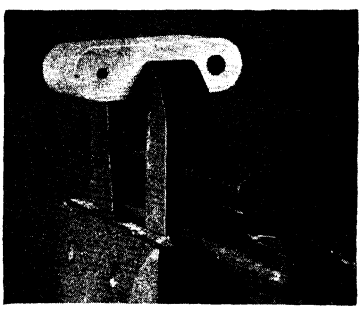


Fig. 13.—Shaping Connecting Pieces.

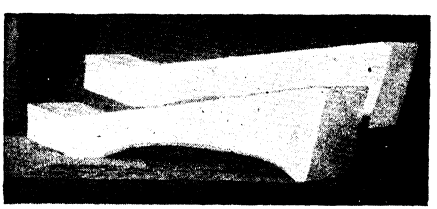


Fig. 12.—Gun Carriages (Two) Shaped.

not feel confident in boring the hole straight, it will be as well to have the original wood of somewhat larger dimensions than that given, reducing it after the hole is bored.

The next proceeding is to turn up a piece of wood to fit the hole bored in the gun. It should be about 4 in. long, and must fit fairly tightly in the hole, but not so tight as to risk splitting. This small piece must be cut in two in the middle, and one piece driven into each end of the gun; the latter can then be mounted in the lathe and turned to shape. The purpose of the small turned piece will now be seen, and that is to act as a mandrel on which to turn up the gun, and thus to make certain that the bore is in the centre.

On the end of the gun which has to fit into the breech part must be turned a pin $\frac{3}{4}$ in. in diameter, to fit into and form a means of attaching the one portion to the other.

For the breech portion of the gun a piece of wood 5 in. long by 2 in. in diameter will be required, and this must be bored in the same way as the other before turning. The only difference is that a $\frac{3}{4}$-in. hole must be bored to the depth of 3 in. from one end, and then continued as a $\frac{5}{8}$-in. hole after, and in turning up it must be remembered that the barrel portion of the gun already made fits into the larger hole.

A mandrel is turned up to fit the two holes in the same way as before, and then the part of the gun can be turned on it, easing off that end where the larger bore is, so as to bring it down to the part to which it fits, but cutting off the other end quite clean and straight.

Fig. 11 shows these two parts after they are turned to shape and size. If the pin on the longer piece is turned to the correct size, the two pieces will now fit together and form one, being eventually glued; but this should be left until later.

A small hole must now be bored at each side for the insertion of the trunnions on which the cannon will pivot, and the trunnions can be inserted and fixed at once with glue. They are turned up in a screw-chuck or on the faceplate; of course, they must not run through or the clear bore of the gun will be obstructed.

The carriage can next be made; the size has already been given, and the shape is shown in Fig. 12. These can be worked to shape a number at the same time, two being shown in Fig. 12.

The connecting pieces (Fig. 13) may also be worked several at once, boring the small hole for the trunnions and the larger one for the axle at the same time. By squaring over the position of the holes and boring from each side, it is possible to make them meet in the middle sufficiently true for the purpose.

The axle comes next, and is turned as shown in Fig. 14. The larger middle portion is nearly 1 in. in diameter, and slightly less in length than the carriage (Fig. 12) is in width. The next larger portions must be an easy fit in the larger holes in the connecting pieces (Fig. 13), and the other parts should be a tight fit in what will be the centre hole of the wheels, that is, about $\frac{3}{8}$ in. The length of the smaller parts should be about $\frac{3}{4}$ in., and that of the other parts about $\frac{1}{8}$ in. less. The exact length does not matter, so

that both ends correspond. The extreme ends should be neatly rounded off, so as not to be conspicuous.

Instructions on turning the wheels are given in another chapter of this book, and there is nothing to add except that the centre opening must be a good fit on the axle ends

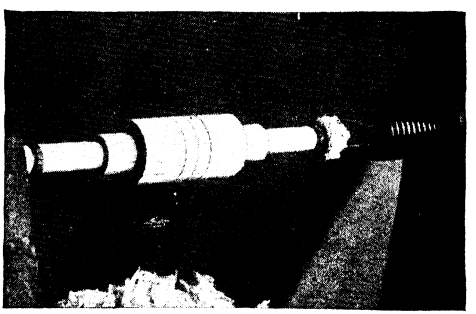


Fig. 14.—Turned Axle.

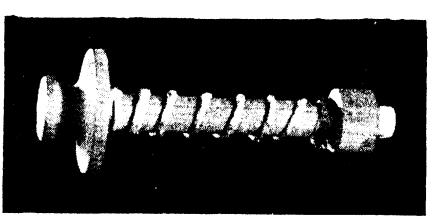


Fig. 15.—Plunger with Collar and Spiral Spring.

so that a touch of glue at the proper time will fix them, and that the present wheels must finish about $\frac{5}{8}$ in. thick at the rims, and they should be of the same width at the hubs.

The plunger, which acts instead of a cartridge, is shown complete in Fig. 15. The extreme end on the left is turned so as to form a finish to the breech end of

the gun, and the shank is turned in one piece with it. This part must be just an easy fit in the small hole at the breech ends so that it will slide easily in it. The collar on the right must be an easy fit in the large bore of the same part of the gun, as far as the outside is concerned, and the opening must fit tightly on the small part of the plunger, so that no other fixing than glue will be necessary. This end of the plunger is a somewhat important part, and in Fig. 16 is shown how to turn it up and cut it off.

The plunger when in use is fitted with a spiral spring as in Fig. 15, and is operated by pulling the breech end back as in Fig. 17, the recoil of the spring projecting the shot.

Fig. 18 shows the gun put together as so far made, but minus the wheels; and now has to be added the arrangement for raising and depressing the muzzle of the gun. This consists of a collar fitting loosely on the large end, which is cut through to make two, only half being required for one gun. The half of the collar is pivoted to the gun by the free ends, the bottom being connected to a stem which passes down through the carriage, the hole for it being made so that it is friction tight, and enlarged on the under-side to allow the stem to play backwards and forwards as the gun is raised or depressed.

The collar should be turned to a flat curve on the outside to give it a less clumsy appearance, as shown in Fig. 19, the full width being about $\frac{1}{2}$ in., and the thickness about $\frac{1}{4}$ in. The illustration shows the collar being cut off.

The stem to which the half of the collar is fixed is simply turned up to $\frac{3}{8}$ in. in diameter and cut off 3 in. long.

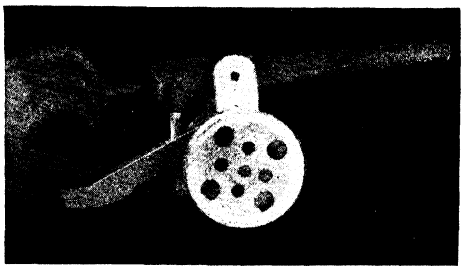


Fig. 17.—Method of "Firing" Cannon.

Fig. 16.—Turning Collar of Plunger.

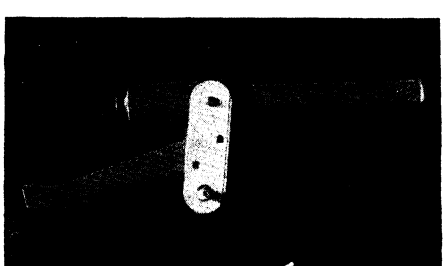


Fig. 18.—Cannon without Wheels or Raising Gear.

One end is fitted to the middle of the collar, to which it is screwed from the inside. It is then passed down through the hole in the carriage made for the purpose, and the

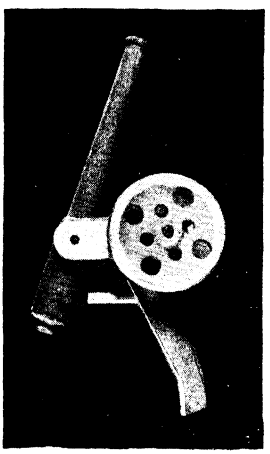


Fig. 21.—Cannon at Lowest Elevation.

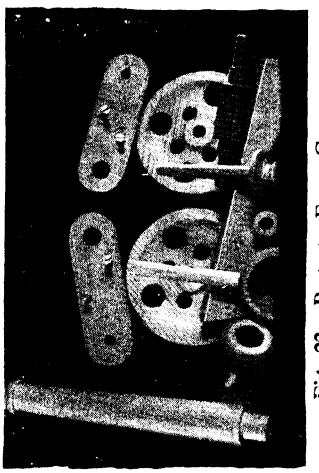


Fig. 22.—Parts to Form Cannon.

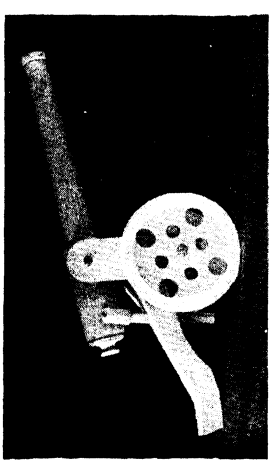


Fig. 20.—Cannon at Highest Elevation.

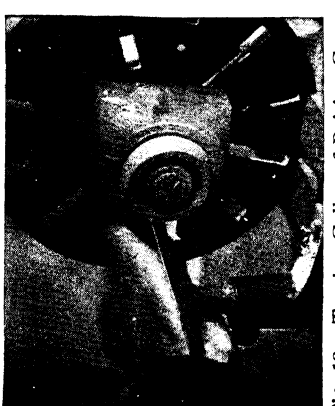


Fig. 19.—Turning Collar of Raising Gear.

collar pivoted to the gun with a small screw at each side.

The purpose and action of the raising and depressing arrangement are shown in Figs. 20 and 21, which illustrate the gun at its highest and at its lowest elevation respectively, the stem passing through the carriage being just tight enough to hold it at any point between the two extremes.

To put the cannon together proceed as follows: Pass the plunger into the back end of the breech part, slip on the spring, and then the collar, first coating the inside of the latter with Seccotine or some similar adhesive. Then place the barrel portion of the gun in position; the pin on this will prevent the spring from forcing the collar off before the glue is dry.

One of the connecting pieces can next be screwed to the carriage, the axle, raising stem, and the gun placed in position, and the other connecting piece screwed on to the carriage. This finishes the cannon, which should be taken apart for painting or staining.

In boring the barrel of the gun it is quite possible that a certain amount of roughness may be left from the boring bit. To clear this and make the bore absolutely smooth, a hot iron may be run through the bore; or, what will be better, a round strip may be turned up in the lathe and a strip of glasspaper glued round it, making it into a file. On sliding the barrel on this and holding it firm while working the lathe, the bore will soon be smoothed. Fig. 22 shows a complete set of the parts required to make the cannon.

CHAPTER III

A Fort and Entrenchments

Toy military devices and appliances are at the moment popular with the younger generation. As an accessory to standard toy soldiers a properly designed fort will be welcomed by every boy, and if, as in the model illustrated by Figs. 23 to 26, it also comprises earthworks and entrenchments, so much the better. As many readers know, Mr. H. G. Wells has by his book, "Little Wars," brought "toy soldiering" to a science. By his rules the movement of a model army is as interesting and may be as intricate as a game of chess. To play at "little wars," buildings and other details of a battlefield make the campaign more a matter of skill, and a fortification may play an important part. Entrenchments and artillery earthworks are provided in the model here illustrated, and these are formed so that they may be arranged in irregular or polygonal plan, as the "commander of the forces" may so direct.

All the earthworks are made of triangular strips of wood of the section shown in Figs. 27 and 28. The strips measure 4 in. long at the centre line, and the ends are cut at an angle of $22\frac{1}{2}°$, so that three pieces placed with the adjacent ends as shown will make a right angle in the earthworks. The ends are cut in opposite directions to enable a straight line to be formed. The making of the

small earthworks is obvious. A strip of stuff is planed up to the section and cut off in a mitre-box to the required length. To make the larger pieces, the stuff can be obtained sawn to the size out of 1¼-in. boards. The lengths having been obtained, the first operation should be to cut them into the 4-in. angled pieces, a stop being arranged in the mitre-box to ensure the lengths being equal. Fig. 29 shows the successive operations. After this the mitre-box may be arranged with a horizontal cut at the end and another inclined cut (see Fig. 30), to form the embrasures through which the guns project. The work should proceed by each process being dealt with separately on all the pieces being made. The stops in the mitre-box should be screwed in so

Fig. 23.—Photograph of Model Highlanders behind Model Trenches.

that they may be readily moved for each successive operation.

Before finishing (that is, painting and sanding) the fort itself may be tackled. Whatever the size of the fort.

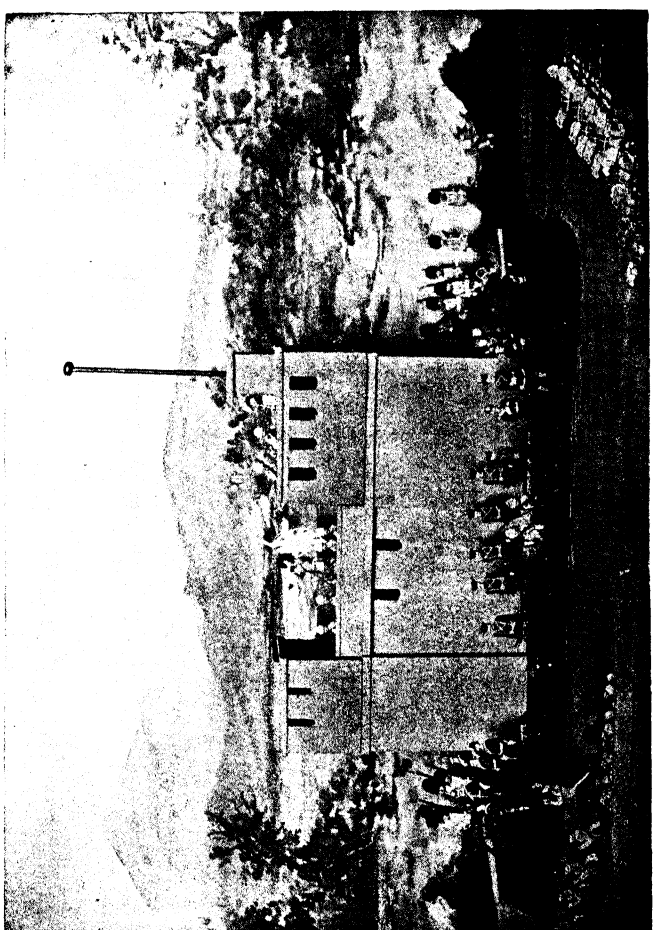
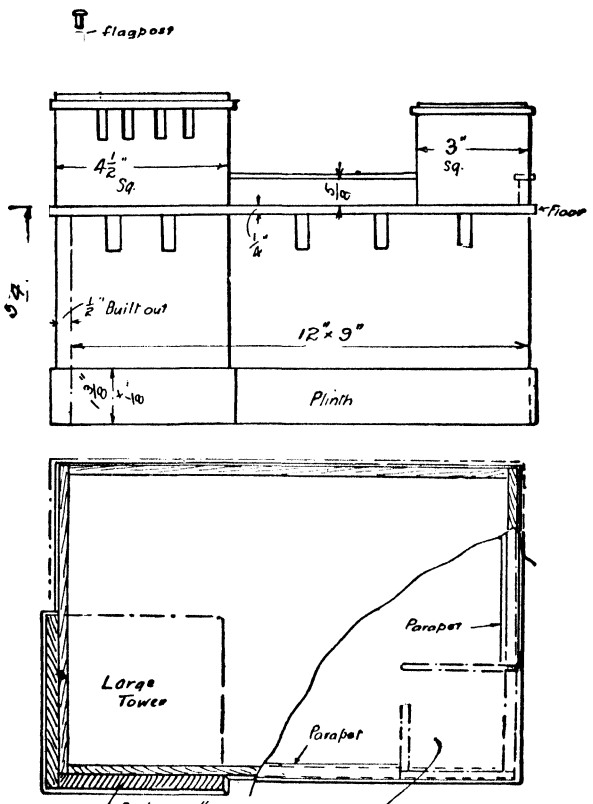


Fig. 24.—Photograph of Model Fort Complete.

the *scale* of doorways, openings, etc., is the same, so as to make them usable with the standard sizes of soldiers.

Figs. 23 to 26 show one of the simplest types of fort,



Figs. 25 and 26.—Elevation and Plan of Fort.

the main building being a square box with a top or floor overhanging the sides. The loopholes are cut in from the top, so that the difficulties of piercing are eliminated.

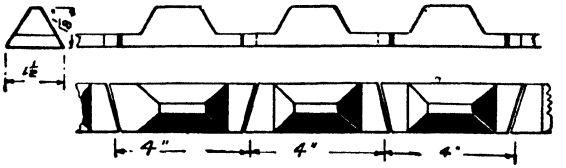


Fig. 27.—Earthworks.

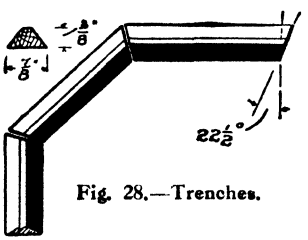


Fig. 28.—Trenches.

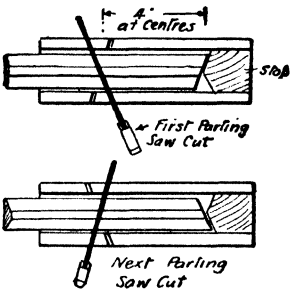


Fig. 29.—Method of Cutting "Earthworks."

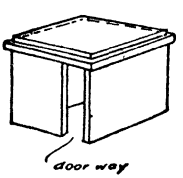


Fig. 31.—Small Tower.

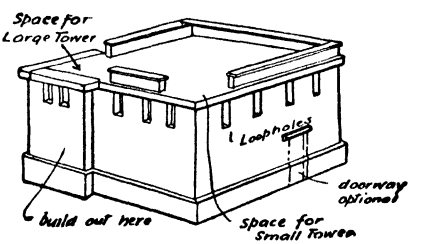


Fig. 33.—Body of Fort.

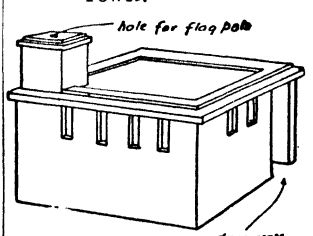


Fig. 32.—Large Tower.

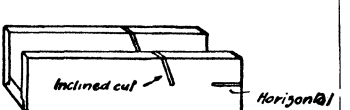


Fig. 30.—Special Mitre-box.

Two cuts, one on each edge of the slot, are tenon-sawn down and the superfluous stuff chiselled out; or a boring bit could be run through to form the bottom of the slot and the saw cuts then made from the top. The portion immediately under the large tower is built out to relieve it of any boxlike appearance. This may be done by planting on to one corner two pieces of $\frac{1}{2}$-in. wood the width of the tower, and adding a plinth strip at the bottom.

The towers (Figs. 31 and 32) are simply reductions of the main building, the larger of the two having loopholes, and a flag turret made of a piece of 1-in. by 1-in. square wood capped with $\frac{3}{16}$-in. stuff. Both towers have doorways made by leaving one side shorter to the extent of the width of the doorway. The top of the fort has a parapet $\frac{5}{8}$ in. high out of $\frac{5}{16}$-in. wood, and capped by $\frac{3}{8}$-in. by $\frac{1}{4}$-in. stuff as shown in Fig. 33.

No great amount of finish need be attempted in any part of the toy fort. The joints should be square, and all feathery edges should be glass-papered off. The model and the earthworks should be primed, and when dry a mixture of white paint, toned down with black to a grey, and common varnish should be made up. A large brush and a box with some silver sand should be procured. The parts should be painted with the varnish paint, and while wet the sand should be liberally sprinkled over the surface. One mixing of the paint-varnish should be made up for the whole job to ensure the colour being the same. The earthworks may be a little darker.

The towers are not fixed; after the fort has been used it may be inverted so as to hold all the loose parts.

CHAPTER IV

Scooters or Cycle-Skis

A COMPARATIVELY popular toy with boys is the cycle-ski or scooter. It seems as a means of propulsion to have replaced in juvenile affection the famous "single skate," to which in principle it is so closely akin.

A simple, cheaply made, and durable type of scudder is the wooden wheel variety; but the wheels are rather more expensive to produce than the small cast-iron wheels which are extensively used for the purpose, and which can be very cheaply purchased. As, however, the wooden-wheel scudder is the most satisfactory in use wherever paved thoroughfares abound, these notes will be concerned with its construction.

Scooters are, for preference, made from a close-grained hard wood; beech or birch are both excellent materials for the purpose. The simplest pattern (Fig. 34) comprises a stout foot plate (Fig. 35), two wheels (Fig. 36), bracket piece (Fig. 37), and a front steering head (Fig. 38), which carries a light iron chair (Fig. 39) that engages with and swivels upon the bracket piece. The following sizes for these several pieces will be found convenient: Steering head, 30 in. by 2 in. by 1 in.; footplate, 19 in. by $2\frac{3}{4}$ in. by 1 in.; wheels, 5 in. in diameter by 1 in. thick; while the bracket piece can be $\frac{5}{8}$ in. to $\frac{3}{4}$ in. thick and about $3\frac{1}{2}$ in. to 4 in. across the base; total height, 5 in. to 6 in.

Fig. 39.—Metal Chair.

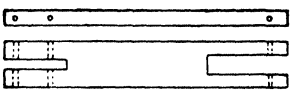


Fig. 35.—Footplate.

Fig. 34.—Scooter or Cycle-ski.

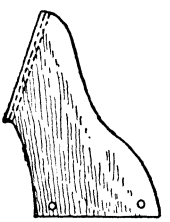


Fig. 37.—Bracket Piece.

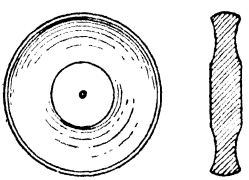


Fig. 36.—Wheel.

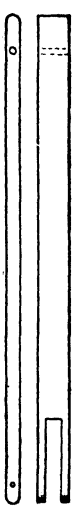


Fig. 38.—Steering Head.

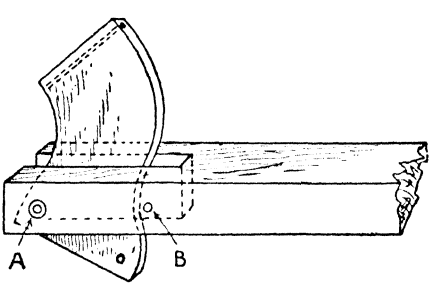


Fig. 40.—Method of Folding Bracket Piece.

The edge that is bolted to the chair should be approximately at an angle of 60° with the base and about 3½ in. long. The metal chairs are bent up in the vice cold from ¾-in. by ⅛-in. strip iron, and should be about ¼ in. longer between the ends than the bracket pieces that fit into them. A hole $\frac{9}{32}$ in. in diameter should be drilled in each return or end, and accurately in line one with the other; also two holes for 1-in. No. 10 gauge iron screws must be drilled and countersunk in the back, which allow of its being fixed to the steering head at a height governed by the height of the bracket piece.

The foregoing sizes will produce a strong scudder suitable for a boy of eight to ten years of age; but any materials that approximate to these sizes will prove equally serviceable, the main requirement being that the length of wheel base is not unduly shortened, for consideration of both ease in running and foot room. For young children the height of the steering head can easily be reduced by 6 in. or 8 in.

With the exception of the turned wheels, all the parts can be made on the bench. To begin operations, the footplate, steering head, and bracket piece should be cut to size and shape and cleaned up. In the centre of the lower end of the steering head, and through the widest way, a slot should be cut 4 in. long and 1 in. wide (Fig. 38). A similar slot should be carefully cut in the footplate for the rear wheel, while at the front end there should be a slot corresponding with the length and thickness of the base of the bracket piece which it is intended to receive.

This bracket piece is held in position by two bolts,

each with cupped heads and 3 in. by $\frac{1}{4}$ in. in size. The front one A (Fig. 40), has a square nut while the rear one B is fitted with a thumb-nut, so that if the scudder has to be packed up the bolt can be easily withdrawn, when the bracket piece can swivel on the front bolt into a convenient position for holding the steering head parallel with the base.

The bracket piece, which has to stand considerable strain, should be cut from good, dry, stiff timber, and the bolt hole that goes edgewise through it and about $\frac{1}{2}$ in. in must be very carefully drilled to ensure accuracy. Of course, it can be done with a hand brace; but a better method, if a lathe is available, is to rig up a small table, on which the bracket piece can be guided to the drill with the aid of a fence set parallel thereto. This hole should be bored to take a $\frac{3}{16}$-in. bolt. Through the edge and about 1 in., not less, from the ends of the wheel slots, holes should be drilled to take $\frac{3}{16}$-in. pins, which act as axles for the wheels.

In assembling, it is advisable that the wheel pins should be pointed one end, while the holes for their reception are only partially drilled through on one side, which secures a tight fit when the pin is driven in. In drilling for the bracket bolts it will be as well to set up the former in the footplate slot, and drill through the lot. This method will ensure a clear way through being drilled.

The bolt which connects the bracket with the steering-head chair should carry a light washer at the top and bottom of the former, and after the nut has been screwed into position, the end of the bolt should be riveted over it.

Before assembling, the various parts should be sized, rubbed down, and varnished to give a finish. The bodies of the wheels, if desired, can be relieved with a little colour. Care should be taken in assembling to see that neither the steering-head wheel ends or those of the front plate become split in the operation of inserting the wheel pins.

The wheels (Fig. 36) are best turned from round timber of a suitable diameter; but if difficulty is experienced in connection therewith, it can be overcome by substituting cast-iron wheels, the slot in the steering head being modified in width accordingly. A cheap handle can be made for the steering head from a short length of dowel stick inserted in a hole bored through from edge to edge for its reception as shown in Fig. 38.

CHAPTER V

Railway Signals

A TOY signal is shown complete by Fig. 41, and the principal measurements are given on Figs. 42 to 47.

The post A is $\frac{3}{4}$ in. square, and is mortised into the foot B. The rocking arm C is 4 in. long, $\frac{1}{2}$ in. wide, and $\frac{1}{4}$ in. thick. A piece of lead is wrapped round near one end and secured with a nail to act as a counter-weight (a circular disc of lead might be cast for this and would be more realistic). The arm rocks on a centre (a round-head screw) $3\frac{1}{2}$ in. above the foot.

Fig. 41.—Railway Signal.

The signal arm D is of $\frac{3}{16}$-in. three-ply wood 5 in. long, and pivots on a screw 11 in. above the foot. Details of the shaped end are given in Fig. 45. The two arms are connected by a piece of stout wire E so as to work in unison. This wire is bent as in Fig. 46. The short limbs are first passed through holes in the arms and are then bent.

The lever F is 5 in. long, $\frac{5}{8}$ in. wide, and $\frac{1}{4}$ in. thick,

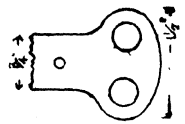


Fig. 45.—End of Signal Arm.

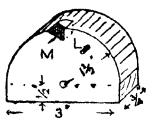


Fig. 47.—Block.

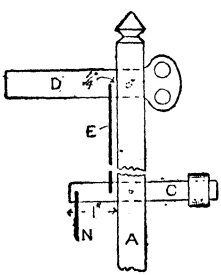


Fig. 44.—Detail of Signal.

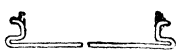


Fig. 46.—Wire for Connecting Signal Arm and Rocking Arm.

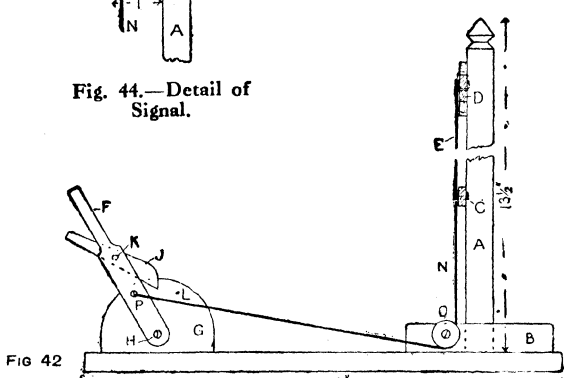


FIG 42

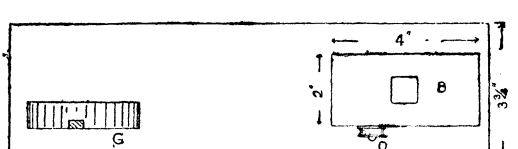


FIG. 43

Figs. 42 and 43.—Elevation and Base Plan of Signal.

pivoted to the block G by the screw H. Behind this lever is a smaller one J, working on a pivot (small screw) K, and engaging in a notch cut in the block G. Details of the block G are given in Fig. 47. A pin L prevents lever F from falling too far over.

Fig. 42 is not strictly correct, because the signal arm is at "danger," and the lever F should have been resting near the pin L. It is given to show how the small lever J engages in the notch M (Fig. 47).

The plan (Fig. 43) shows how the lever block and the foot of the signal post are arranged on the base. A piece of string N passes from the rocking arm round the pulley (or a screw-eye) O to a small screw P on the lever F. This string should be just long enough to attach to the screw P when the lever is resting against the stop pin L and the signal arm is at danger. Then on pulling over the lever, as a signalman would do, the small lever J engages in the notch M and holds the signal arm down. On releasing J, the signal arm is pulled back to "danger" by the counter-weight, and lever F is pulled against the stop L.

CHAPTER VI

Horses

A TOY horse, suitable for a boy of from six to twelve years of age, is shown by Figs. 48 and 49, and pine is a suitable wood to use.

The body consists of a block having notches cut at the four lower corners for the legs, and a slot at the front end of the top for the head (see Fig. 50). This will be found simpler than connecting the different members by dowelling. The legs are marked out to the form shown in Fig. 51, and cut through square to the surface of the board, the wood being arranged as shown so as to get as much long grain as possible.

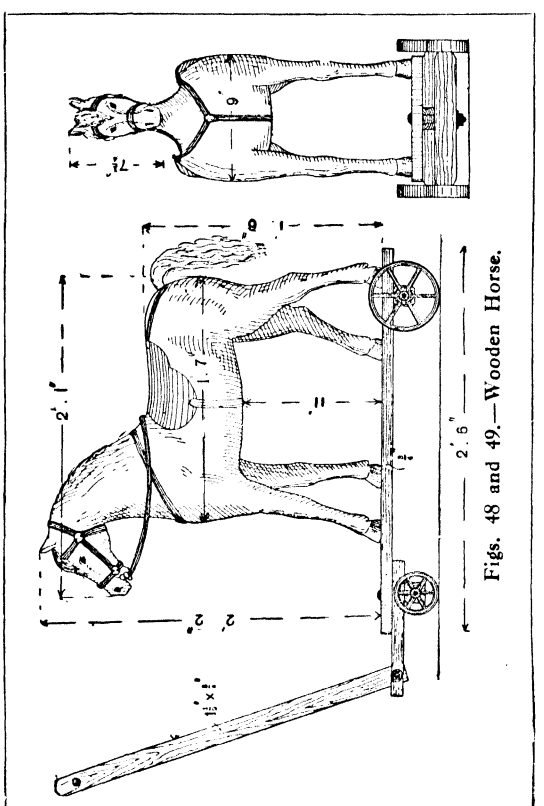
The head consists of three pieces (see Fig. 52), one forming the nose, ears and neck, and the others forming merely the thickening of the neck. The centre piece fits down to the bottom of the socket in the body piece, whilst the side pieces fit on top of the body.

Having sawn out all the pieces and fitted them, glue them together as shown in Fig. 50, inserting for additional security a couple of hard-wood pins through the legs into the body. After this, the whole should be shaped, a sharp drawknife being very useful for this purpose, but it must be carefully used or it will tear off pieces with the grain where not required. Further shaping may be done with a spokeshave, and, in the case of the nose and other

parts of the head, with a gouge and chisel. For finishing, a rasp and file may be used, and will be especially useful for the lower parts of the legs.

A piece of board about $\frac{7}{8}$ in. thick should be prepared and cut to shape for the platform, and to this each leg can be secured with a stout 3-in. screw.

The turning arrangement in the front, illustrated by



Figs. 48 and 49.—Wooden Horse.

Fig. 53, is attached to the platform by means of a bolt and nut, and the wheels, if desired, can be cut in hard wood

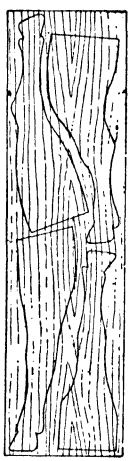


Fig. 51.—Board marked out for Legs.

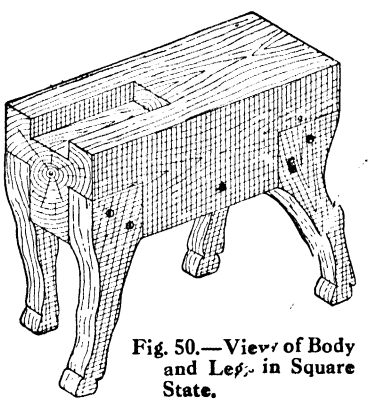


Fig. 50.—View of Body and Legs in Square State.

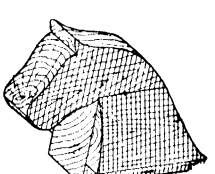


Fig. 52.—View of Head.

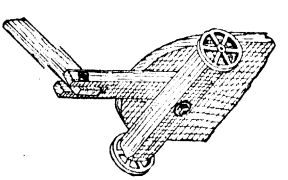


Fig. 53.—Front Turning Arrangement.

and left solid; or suitable iron wheels may be fixed to the axles with stout 4-in. screws.

All the parts should be rubbed down smooth with the glasspaper, the whole then receiving a coat of priming and

three or four coats of good drying oil colour, the finishing coat being grey or brown according to taste. Suitable pieces of scrap leather for the harness can be obtained and fixed as desired.

For the mane and tail, horsehair is required; this can be had with hair attached to the skin. For the mane it should be glued and tacked on, and for the tail, a hole should be bored sufficiently large to receive the hair and a wooden plug, this being inserted under the hair and allowed to project about ¾ in. so as to give the tail a natural effect.

Hobby Horse.—The hobby horse shown by Figs. 54 to 56 is of simple construction. As will be seen, the head-board extends downwards, and is tenoned into the axle-tree of the bottom wheels. The legs carry the front wheel, as shown, by means of a centre bolt and nut, a bolt and nut also being used to adjust the legs. The saddle is adjusted by means of pins passing through holes, the side brackets being fixed to it by housing and gluing.

Skin-Covered Toy Horses. — Skin-covered toy horses of the cart-horse type with hollow interior have been made almost exclusively in Germany, and can only be manufactured by means of a fairly extensive plant. They are high-grade goods, for which a good price is obtained, and their production might be experimented in on the following lines: A model of the body of the size required should first be formed in clay, the legs and body in such a model being built up on a rough framework of wire. The clay to use should be moist modelling clay, known also as fireclay. Such details as ears, hoofs, etc.,

should be omitted in the model. The next operation consists in making a cast of the model in plaster of Paris. This must be carried out in four distinct castings. One casting on each side embraces the flank, one-half of the body, and half the neck and head. Then follow two other castings of the inside of the legs on each side, and one-half of the belly. This casting might be carried out in one operation. In each instance, the former casting should be allowed to dry completely before another is superimposed, and the face of the former portion must be well saturated with linseed oil. The casting of such objects in such a system of "piecework" is in itself an art not to be mastered completely within the first fifty attempts. The system throughout in such work is to avoid locking of the original model with the cast, by the plaster running under overhanging portions. After its release from the model, the cast should be set aside for a week or ten days—longer, if possible—before further use. The three or four portions of the cast will now serve as an impression on which the models in paper may be constructed. Papier-mâché modelling is carried out by first well oiling the casting surface of the impression with linseed oil, and then covering it with several coatings of moist paper, applied in small pieces by means of good flour paste, each successive coating being well beaten into position by means of a moist nail-brush. In the course of a week or so the paste will have completely dried, and the model may be released.

Then, having pared down the edges of each separate portion, the model should be assembled by joining it up with strips of butter muslin well glued along the joints.

The two sides of each leg may be better brought together by a spiral twisting of the same material down their length. A small piece of cork glued in and a short galvanised wire should be inserted in the hollow of each leg.

The most difficult operation now follows—that of cutting out the skin. A rough pattern may be obtained

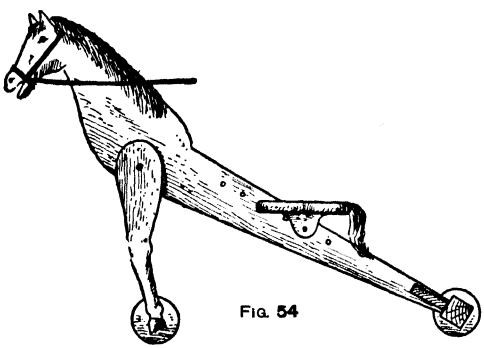


FIG. 54

Fig. 56.—Front Legs and Wheel.

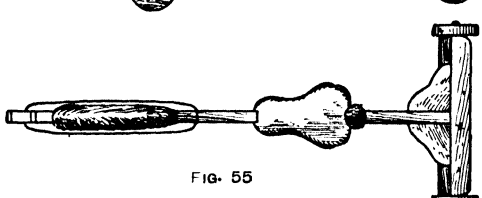


FIG. 55

Figs. 54 and 55.—Elevation and Plan of Hobby Horse.

by making a second model much thinner, either in strong paper or soft fabric, in the manner described; and, having trimmed it up into correct detail, to cut it at certain points so that, under pressure, the various parts will flatten out. In laying out the pattern on the skin to be cut, however, a full margin should be allowed at certain points, and, moreover, the skin should be cut in one piece to obviate the necessity of a join down the front of each leg and down the centre of the back.

The skin used in the covering of such models may consist of very thin calf skin from the area of the inside of the legs and fore part of the belly, this being the thinnest to be obtained. Such hide, moreover, would require to be pared down as closely as possible to render it workable. Before being placed on the model, it will require continuous soaking for a few days to render it perfectly pliant. Before the skin is placed on the model, the latter should receive a thick layer of soft modelling clay throughout, and veins in the area of the legs and shoulders counterfeited by means of short lengths of wire laid across. The sewing up is effected by means of a special skin stitch. The needle is inserted under the skin (on the flesh side), brought over the edge, and again passed through in the same way on the other portion. The hair should afterwards be clipped to an even, short length.

The lips and hoofs will now require modelling in gilder's putty, and at this point it will be found more convenient to attach the model to a stand of wood by means of the wires passing out of the legs. The ears can now be cut out of a portion of spare skin and attached with glue, and artificial eyes inserted. The mane and tail may be formed of real horsehair, and secured to the model with glue and short pins driven through the portion of skin to which it is attached. The hoofs, lips, and interior of the ears will require a little painting.

Such toys, if made on a solid body composed of wood shavings or tow, would be far less trouble to make than with a hollow interior.

CHAPTER VII

The Finishing of Wooden Toys

VARIOUS hints on the finishing of wooden toys are given throughout this book, but some general information on the subject may here be presented.

Wooden toys may be finished quite bright and in various colours. Assuming that they are intended to be finished in three colours (bright yellow, mahogany, and walnut), have at hand three separate bottles, each containing 1 pt. of methylated spirit; empty wine bottles (six to a gallon) do capitally. In one bottle put twopennyworth of gamboge crushed fine for a yellow stain. In the second bottle put one pennyworth of bismarck brown for mahogany. In the third bottle put an equal quantity of spirit walnut stain for walnut. Should the bismarck give a too garish red, add a small proportion out of No. 3 bottle to soften the tone. Similarly, a small proportion out of Nos. 1 and 2 may be added to No. 3 to yield a more pleasing colour. Next to each of the bottles add one-sixth part of french polish, which will act as a binder, and thereby prevent the colour rubbing off. Have at hand three empty jam jars, into which the separate stains can be poured for use; also three camel-hair brushes. Coat the toys with the yellow first, mahogany second, and walnut last. In an hour's time the toys should be ready to coat with varnish, the same varnish being laid over all three colours.

A suitable varnish can be made by adding to each pint of white french polish (which is best bought ready made) one pennyworth each of amber resin and gum sandarach. Frequently agitate, and strain through muslin before using. One pennyworth of camphor added to each pint of varnish causes the toys to give off a pleasant smell. Set aside in a fairly hot room when varnished to assist in holding out bright and hardening.

Bright varnish for toys and small wood articles may be made as follows: Sandarach 3 oz., copal 1½ oz., mastic 1½ oz., best turpentine ¼ pt., powdered glass 2 oz., spirit 1 pt. Dissolve on a water-bath.

A more durable bright varnish, for articles that have to stand wear, is prepared by dissolving on a water-bath: Picked sandarach 4½ oz., mastic in tears 1 oz., powdered glass 2 oz., spirit 1 pt. The varnish may be rendered more fluid by the addition of 8 oz. of liquid Venice turpentine, after which it should be filtered.

A very bright and quickly-drying varnish is made of sandarach 1¾ oz., mastic in tears 1¾ oz., copal 1 oz., oil of lavender 1 oz., spirit 1 pt. Slightly damp the copal with oil of lavender, and melt it in a well-glazed vessel on a slow fire; then run on a cold marble slab and powder. Add this powder to the powdered sandarach and mastic, and dissolve on a water-bath in the alcohol. After solution, add the lavender oil, still stirring.

Shellac may be dissolved with borax if 3 parts of shellac and 1 part of borax are added to 25 parts of water and the whole is moderately heated. The solution thus obtained is in itself an excellent varnish. It may be incorporated

with oil colours by rubbing out these with a little oil, and then mixing with the varnish. The mixture dries within ten or fifteen minutes, and should be prepared only as required.

Brown spirit varnish is made of shellac 2 lb., gum sandarach ½ lb., methylated spirit (60 over-proof) 1 gal. Shake until the gums are dissolved, and add warmed Venice turpentine ¾ lb. Shake until thoroughly mixed, and afterwards strain. It should be kept for a week or ten days previous to use.

Another spirit varnish is made of 4 oz. shellac, 2 oz. resin, ½ oz. gum benzoin, ½ oz. gum thus, 1 pt. methylated spirit. Crush the gums, pour in the spirit, and set aside in a warm place, frequently shaking the bottle. Carefully strain before using, and apply with a camel-hair brush.

Black varnish is made of thin orange shellac 3 oz., spirit 1 pt., Venice turpentine (previously liquefied) ¾ oz. Dissolve on a water-bath, and then add about ½ oz. lamp-black.

Dark varnish is made of thin orange shellac 3 oz., Venice turpentine ½ oz., spirit 1 pt. Dissolve the lac and turpentine in the alcohol on the water-bath.

The best white hard spirit varnish is made by dissolving 1 lb. of fine picked gum sandarach in ½ gal. of methylated spirit. Strain and add finest pale turpentine varnish 1 lb. Another kind (dearer) is made of gum mastic 2¼ lb., stronger spirit 1 gal. Dissolve, and add 1 lb. finest pale turpentine varnish.

Painting Toys.—For obvious reasons, the paint used for application to toys of various kinds should be quite

free from all poisonous compounds. White lead cannot, therefore, be used for the purpose, neither can chrome yellow, chrome green, red lead, emerald green, orange mineral, and vermilion.

Broadly speaking, there are two classes of paints used for this purpose. Both are cheap, but answer their purpose. The first consists mainly of whiting to which is added the necessary colouring matter and a little glue-size to bind the parts together. In other words, it is really distemper, which forms a good undercoat for a coat of cheap varnish which is afterwards given to it.

The second class of paints is that in which a proportion of varnish is added to the pigment and thinned. With this the work can be done in one coat. The base is usually a cheap earth colour, such as ochre, sienna, venetian red, purple brown, umber, etc., or an admixture of them. A white finish is far too expensive just now, as zinc oxide is so high in price and white lead is not available. Lithopone would be suitable, but this is also rather expensive.

For reds the best paints to use are those known as "fast reds," such as are made by Messrs. Goodlass, Wall and Co., Limited, of Liverpool. They retain their colour for a long time, and have extraordinary "body" or opacity, so that one coat is amply sufficient. For black use cheap vegetable black in oil, and for blue ultramarine or Prussian blue, both much reduced by the addition of barytes or whiting. Greens may be made of bright yellow ochre and one of the blues named.

If any considerable quantity of toys are to be dealt with, the problem to be faced will be the application of

the paint rather than the cost of the paint itself. The most successful methods are dipping, and spraying by means of compressed air. The success of the dipping process depends on the arrangement adopted for holding the toys while the actual dipping is done and while they are subsequently drying. The exercise of a little ingenuity will overcome most difficulties. To give an illustration, suppose that one has to deal with a large number of very small toys, such as metal or wooden "soldiers." A dipping frame could be prepared preferably of metal, with slots running almost from side to side and close together, and the toys could be very quickly slid into these slots, so that in a few minutes there would be a hundred or so quite close together. A single dipping by hand into the paint would cover them all, and racks over the tank could be used to support them until the superfluous paint dripped off, when other racks close by could be used to hold the metal frame until the "soldiers" were quite dry.

The paint used must be so constituted that too much does not run off or too much stay on. The latter would be sure to result in "fat edges" and "runs," both of which would spoil the work. The thinners for the oil paint may be white spirit in place of turpentine and genuine raw oil, which cannot be improved upon. Liquid driers of good quality should be employed. The quantity required is so small that it is not economical to use cheap qualities, which are very likely to cause all sorts of trouble, particularly if white spirit is used.

If the paint or varnish is applied by means of com-

pressed air, arrangements must be made so that many toys can be fixed in position to be sprayed at one time. Suitable frames or holders must be devised for the purpose. In cases of round toys, an arrangement can be effected by which they are caused to revolve once while the paint is being sprayed on.

CHAPTER VIII

Making Wooden Wheels for Toys

Cheap Built-up Wheels.—In the making of toys of almost every description, wheels are an important factor. Probably it is cheaper to leave wheel-making to firms who specialise in it, but at the same time there is a certain satisfaction in making the complete toy in the one workshop, a sentiment that will appeal to a good many. A lathe is essential to good and rapid work, but the type of wheel shown by Fig. 57 can be made without the use of that tool.

In Fig. 57 is shown a wheel of a very cheap kind. This can be turned out almost as fast as the wheels can be counted. The original consists of the hub, the four spokes, and a wooden rim bent round and tacked to each of the spoke ends. The hub is turned in the lathe, and a number may be turned up in one long length. Fig. 58 shows a batch of four hubs turned in one piece ; but there is no reason why a batch of twenty cannot be turned together. The rings round the hubs form guides for boring the spoke holes, and if these are made in the lathe, it is easy to get them true the other way.

The spokes are made from dowel rods, the only preparation needed being to cut them off to the required lengths, and the rim is a thin piece of tough wood, the whole forming a wheel, but not a very strong or a very handsome one.

An improvement on the above will be to double the number of spokes, a matter of a little time only, and a small extra amount of the dowel rod ; while a still further improvement can be made by the use of ribbon iron for the rim in place of the wood. Should this latter improvement be decided on, the correct length of the ribbon for the rims should be ascertained by experiment ; also the

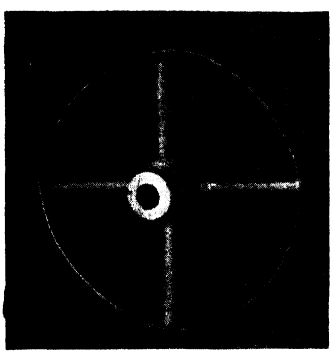


FIG. 57

FIG 58

Figs. 57 and 58.—Cheap Built-up Wheel and Batch of Four Hubs.

position of the holes to coincide with the ends of the spokes. These holes can be punched through easily, and the rims can be fixed with veneer pins.

Wheels of this description can be made almost as quickly without a lathe as with one. The material for the hubs can be planed up to an octagonal section in a long length, bored for the spokes in the middle of each of the eight sides, next cut off to length in a cutting trough, and then put together in the same way as already described for the

turned hubs. The result is an equally strong wheel, but not of quite so good appearance as that described earlier.

Turned Wheels.—Fig. 59 shows two different kinds of wheels turned up in one piece only and finished in the lathe. The one (on the left) is solid, and is shown in front and back views just as it left the lathe. These wheels are best turned up, as shown in Fig. 60, out of a solid block of wood fixed to the faceplate or screw-chuck. The illustration shows the block turned parallel, and one wheel shaped on the end, the cutting-off process being just begun. Fig. 61 shows the cutting-off being continued, the tool being advanced until the wheel drops off, when another can be shaped on the wood and the cutting-off done again. In using the cutting-off tool, the edge must be advanced to the wood so as to cut instead of scrape. The position shown in the illustration

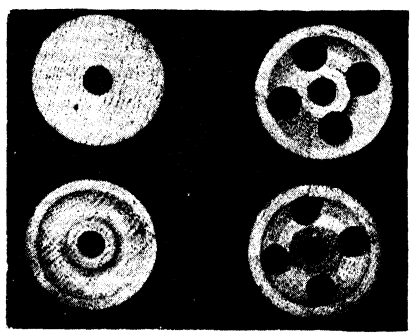


Fig. 59.—Turned Wheels.

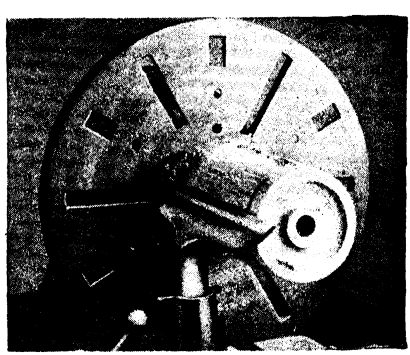


Fig. 60.—Turned Wheel ready for Cutting-off.

is the correct one at the beginning ; but the hand must be gradually raised until the cut is finished.

Fig. 59 shows (on the right) two wheels relieved by piercing ; both are similar with the exception that the

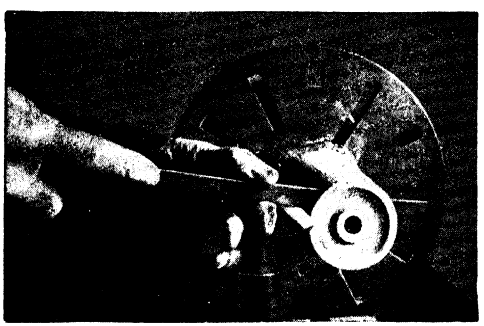


Fig. 61.—Cutting-off Turned Wheel.

Figs. 62 and 63.—Making Piercings in Solid Wheel.

holes are larger in one than in the other. These holes should be bored while the block is on the faceplate, as in Fig. 62, the correct position being marked by square and pencil from the lathe bed, as in Fig. 63. To ensure the four piercings being at equal distances apart, the first two

marks must be placed parallel to the lathe bed before the other two are marked.

In boring the holes a ratchet brace is used, and the lathe bed is a guide to ensure the correctness of them, so

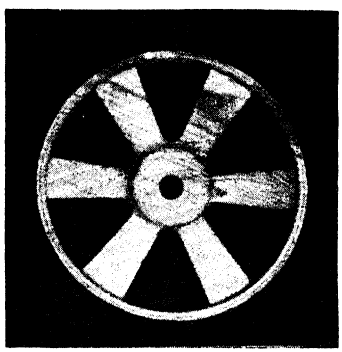


Fig. 64.—Shaped Wheel with Separate Rim.

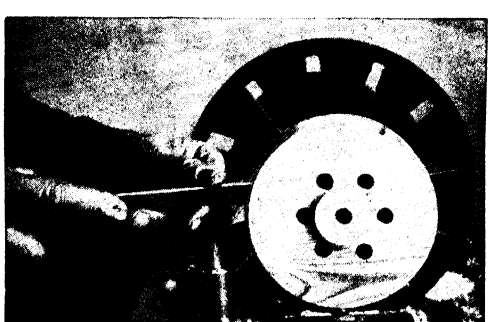


Fig. 65.—Making the Wheel.

that the holes can be bored deep enough for three or four wheels at one time, and the last will be as truly equalised as the first.

Shaped Wheels with Separate Rims.—A larger wheel, and one more like the regulation article, is that

shown by Fig. 64. This entails more labour than those already described. It is made up in two parts, each of which can be turned up in numbers together. In Fig. 65 is shown what may be termed the combined hubs and

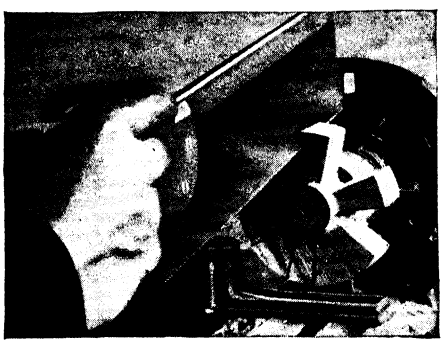


Fig. 66.—Cutting away Waste in Wheel-making.

Fig. 67.—Turning Wheel Rims.

spokes shaped, and the first cut towards dividing them being made. The six holes are the first stage of the spoke openings, which are shown marked and some of them cut in Fig. 66. This illustration also shows the method adopted for cutting away the spare wood.

The whole of the dividing cuts should be started before the waste wood is cut away; but they must not be made too deep, or the wheel will be weakened for subsequent operations. In finishing the dividing cuts some care is required to prevent breakage of the spokes.

To make the rims of these wheels a solid block of the required size is turned up on the faceplate, a recess turned in it, leaving the rim the right size for the previously turned interior to fit closely, and a cut round the outside with the dividing tool will release the rim. Fig. 67 shows the block turned up and the first rim released. Besides turning off as many rims from one block of wood as the thickness will allow, a similar number of smaller rims can be turned from the same block, thus utilising the whole.

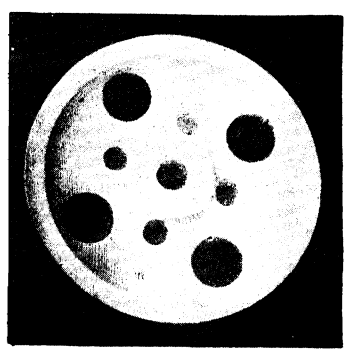


Fig. 68. Large Turned Wheel.

Semi-Solid Turned Wheels.—Fig. 68 shows a large wheel of the semi-solid variety, which will answer the same purpose as those last described, and has the advantage of being in one piece. Instead of cutting away to form spokes, these are formed by piercing with openings of two different sizes, and the rim is turned on the solid. There is a slight difficulty in the cutting-off of comparatively large wheels; but this may be got over by using the cutting-off tool to a convenient depth, and finishing off

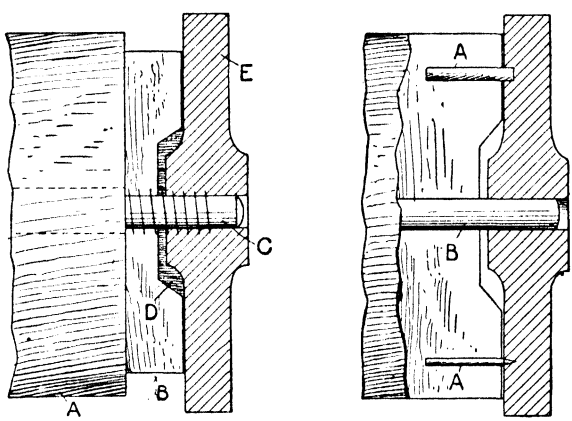
with a saw. This means that a plane is necessary to finish off at the back, which should be avoided as much as possible in order to save the waste of time; but in this case it would be very little, and the slight difficulty may well be faced boldly.

The whole of the wheels already shown are best made in a tough wood of some kind; but at the same time it must be straight grained, or unnecessary work will be required. Some kinds of American white wood are very suitable, while several English woods which are often voted useless, and in consequence can be obtained cheaply, will answer well. Among these may be mentioned horse chestnut, alder, birch, black poplar, and any similar woods.

As a rule, it will be found convenient to run the wheels with a live axle—that is, the axle to be fixed firmly to them and revolve at the same time, rather than to have the axle fixed and the wheels revolve on it. The latter is the usual way with cart and carriage wheels, the former with motor-car wheels.

Method of Turning Wooden Wheels. — In turning wooden wheels that have thickened centres, the best plan is to use one of the chucks shown in Figs. 69 and 70. The centre holes should first be bored right through the wheel blanks, either with a vertical boring machine or with the boring-bit (twist drill) fixed in the lathe chuck, and the blanks well centre-popped to ensure the bit getting a fair start; also noting that the boring pad is at right angles to the lathe axis. Home-made wooden chucks will serve the purpose very well. If the centre hole is $\frac{1}{8}$ in., it will be too large for the ordinary screw-chuck.

The holes could be bored to suit the screw-chuck, and, after turning, enlarged to suit the bearings with a pin-pointed boring-bit. However, assuming the centre holes being bored full-size at the first operation, a suitable size coach-screw can be fixed in the home-made chuck, allowing it to project about 1¼ in. or so, and turning off the thread at the point, which is left plain and an easy fit for the



Figs. 69 and 70.—Wheels held on Chucks for Turning.

⅜-in. hole in the wheels. The plain point is simply to ensure the wheels turning true when reversed, as reversing on the ordinary screw-chuck is apt to cause slight eccentricity occasionally. In Fig. 69, A represents the chuck (made from a block of plane tree, or beech, 4½ in. in diameter and 4 in. long) tapped to screw on the mandrel nose. The part B is best turned up as a separate attachment. It is simply a piece of hard wood temporarily fixed on the screw C, and a recess turned out as at D, sufficiently to

prevent the boss of the wheel E from bearing against the chuck when turning the reverse side.

Fig. 70 shows an alternative form of home-made wooden chuck, which holds the work by means of the spikes A, the centre B being merely a plain pin for centring the work. Three equally spaced spikes (points of flat 3-in.

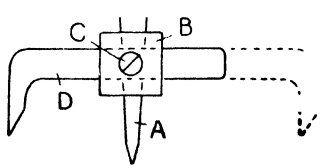


Fig. 70a.—Hole-borer and Disc-cutter.

nails) are driven firmly into the chuck, and the projecting ends, about $\frac{3}{16}$ in. long, filed up to thin wedge-shaped points, which, whilst holding the work quite secure enough for turning, leaves very slight marks on the finished job.

Either of these chucks, with suitable size screw or pin, as the case may be, to suit the diameter of the wooden spindles, will also be suitable for turning small

barrow wheels. Seasoned beech is both cheap and good for this class of work.

Hole-borer and Disc-cutter.—The little tool shown by Fig. 70a has been found very useful for cutting holes varying from 1 in. to 4 in. in diameter. It is used in an ordinary brace. The centre point A was made from a broken $\frac{1}{4}$-in. centre-bit, which was ground to shape, taking the original point as a guide for grinding. The collar B was made from $\frac{5}{8}$-in. by $\frac{1}{8}$-in. wrought-iron bent to shape, drilled and tapped to fit the set-screw C, which is $\frac{3}{4}$ in. by $\frac{3}{16}$ in. in diameter, has two holes drilled and then filed to shape with a small file to allow the centre point A to fit fairly tight. The cutter D was made from $\frac{3}{8}$-in. by $\frac{3}{32}$-in. steel forged and ground to shape, and hardened at the cutting edge; it can be set to make various sizes by means of the set-screw C.

If required to cut discs with square edges to be used as wheels, the cutter should be formed as shown at E—that is, with the bevel outwards. By using two cutters, one with the bevel inwards D, and one with the bevel outwards (as shown dotted), washers can be cut with square edges.

CHAPTER IX

Rocking Horses

A Small and Cheap Rocking Horse.—An easily made rocking horse is shown by Figs. 71 to 73. Good sound deal, 9 in. by 1 in., should be used for the standards, which are diminished in width above the rockers to 6 in., and 1½ in. stuff for the head and seat-board; for the rockers 1-in. stuff will be required.

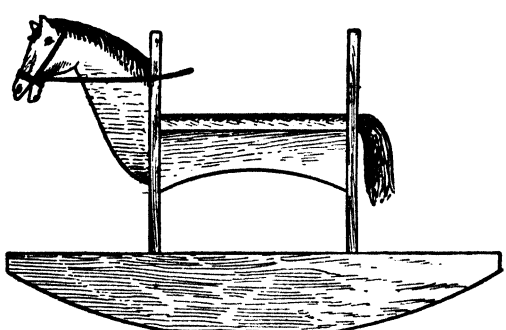


Fig. 71.—Small and Cheap Rocking Horse.

The standards are grooved into the rockers, and secured with screws. The seat-board and the curved belly are housed and part-tenoned into the standards, and then glued up. The head is mortised into the front standard, the tenons "mocking" the seat and belly-board tenons—that is to say, they come in between one another; a small

block of wood glued on each side of the head will give additional strength. The bottom edges of the rockers should be spokeshaved until a straightedge will lay across them, to give a good bearing on the ground. After painting and touching up, the harness is firmly tacked on, and the mane and tail affixed. If the joints are properly made,

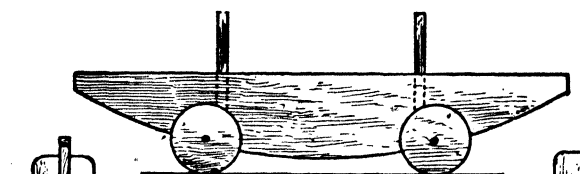


FIG. 74

Figs. 74 and 75.—Rocking Horse Fitted with Wheels.

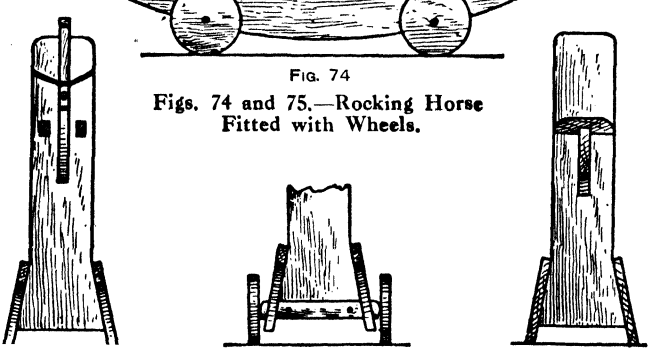


FIG. 72 FIG. 75 FIG. 73

Figs. 72 and 73.—Elevation and Section of Small Rocking Horse.

the rocking horse will be sufficiently strong to carry two children at the same time.

Removable wheels may be fitted, if desired, the axletrees at the under-side being curved to the radius of the rockers, as shown in Fig. 74. The wheels should be of hard wood banded with hoop-iron tyres, which are secured by turning down the ends well into grooves cut across the rims of the wheels. It will be found necessary to use two

nuts locking together on each spindle, the wheels being taken off by removing these nuts. Fig. 75 is a front view of the wheel attachment.

A Well-made "Old-style" Rocking Horse.—In one

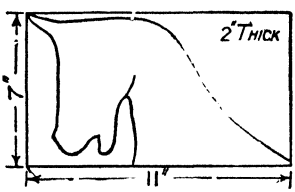


Fig. 76.—Head of "Old-style" Rocking Horse Sawn Out Ready for Carving.

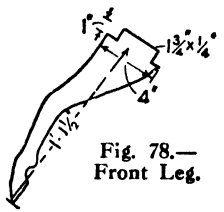


Fig. 78.—Front Leg.

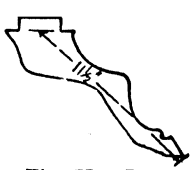


Fig. 77.—Back Leg.

Fig. 79.—Elevation of "Old-style" Rocking Horse.

department of the toy trade at least the English stand alone, and that is in the manufacture of swing, rocking, and pole horses, and those readers who have perhaps attempted to make the ordinary round-shaped wood horse have probably felt a little diffident in tackling the highly

carved and still more highly painted and finished shaped horse. In this chapter will be given instructions so plain and simple on making and painting these beautiful horses that little difficulty will be experienced in following them out.

There are two things that must be forcibly brought home to the would-be horse maker as being essentials to success, and they are: Bone-dry timber and thin, well-made, good quality glue. To sum up, then, granted dry timber and good, properly made glue, the horse will stand all the rough usage it will presently undergo in the vice.

Obtain some thin timber (about ¼ in. thick will do), and roughly plane one side. This is intended for making the patterns, which can be cut out with a bow saw or fret-saw. Three patterns are necessary, and Figs. 76 to 78 show how these are to be pencilled out on the thin boards. Fig. 79 shows the position of the finished parts, and also gives sizes. A simple method is to obtain some large sheets of thin strawboard, and place as many pieces on a bench or table as will cover the whole of the measurements in Fig. 4, and trace out faintly with a pencil.

The following is the timber required for the horse (not the stand): For the body, two pieces of pine 1 ft. 2½ in. by 1½ in. by 5½ in., and two pieces 1 ft. 2½ in. by 1½ in. by 2½ in. One piece of pine 7 in. wide by 11 in. long by 2 in. thick is required for the head, and should be free from knots. One piece of pine 4 in. wide by 8 in. long by 2 in. is required for the head fillets, and this should be cut as shown in Fig. 80. Two pieces of pine 4½ in. long by 3 in. wide by 1½ in. thick are to be sawn to make four pieces

(see Fig. 80). For the legs, take the two leg patterns to a timber merchant, and get him to cut out two of each in birch (dry) $\frac{7}{8}$ in. thick. A few pieces of pine about 3 in. long by 1 in., $1\frac{1}{2}$ in., or 2 in. square will also be required for filling up the ends of the body.

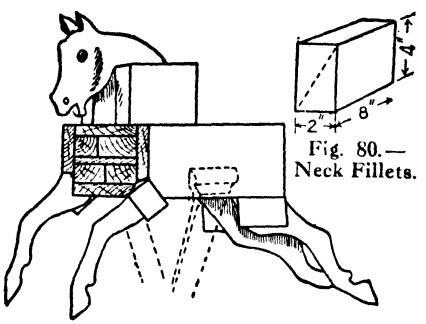


Fig. 81.—Horse Ready for Axe and Draw-knife.

Fig. 80.—Neck Fillets.

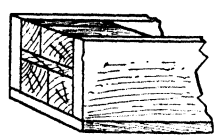


Fig. 83.—Filling Up the Ends.

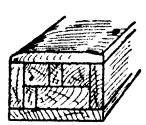


Fig. 84.—Body Showing Back Bevels Run Off.

Fig. 82.—Jointing Body.

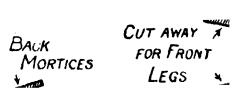


Fig. 85.—Under Part of Body

Everything is now ready to begin to put the horse together, and it will be as well to show at this stage the ultimate positions of the various parts. Fig. 81 shows the horse filleted and jointed ready for the axe. It might be mentioned here that the horse being made is what is known in the trade as the "No. 00 old-style rocker." The first part of the actual making is purely joiner's work, and con-

sists of jointing up the body as in Fig. 82. When dry and set, glue in the pieces to fill up the ends as in Fig. 83, and then plane the edges and joint the top, when the whole will resemble a box with the ends filled up. During the progress of the drying of these parts, the legs and head may be prepared.

The legs should be placed in the vice, and spokeshaved on the edges until they are oval, leaving, of course, the top parts, which mortise. After spokeshaving they should be gone over with a wood rasp, so as to leave the wood rough for painting, and, of course, assisting to shape the leg.

The head is to be levelled first at the bottom for jointing on to the body with the plane, and also at the sides for jointing on the fillets. Now place in the vice. The draw-knife here is required for pulling out the deep cuts, and the worker is advised to obtain a good toy horse or head to serve as a pattern. The main thing is to watch the grain. After roughly shaping the head with the draw-knife, it should be placed flat on the bench (with a few pieces of wood nailed on to the bench to hold it), and finished with a 1½-in. chisel. It is necessary at this stage to shape the face, nose, ears, etc.; a gouge will be required to hollow out the inside of the ears; but leave the bottom of the neck and back of neck, as this will be carved when the fillets are jointed on.

The body should now be placed on the bench for mortising. First run off a slight bevel at the hind part of the horse as in Fig. 84. This should allow of the legs spreading out; the back legs from 3½ in. where they join the body to

6½ in. where they touch the rocker, and the front legs 3½ in. to 7½ in., inside measures. The mortises to be cut will be ¼ in. wide by 1¾ in. long and 1 in. deep, and their positions are shown in Fig. 85. It is after these mortises are cut that the tenons on the leg parts which fit in here should be sawn to ¼ in. and 1¾ in. exact. The piece that comes off to make the ¼-in. tenon should be removed from the outside of the leg.

This done, glue and joint on the legs, then the head, which should come flush with the front of the body and in

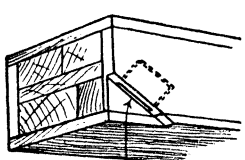


Fig. 86.—Mortices for Front Legs.

Fig. 86a.—Middle Stay for Rocker.

the centre. Then plane the level straight sides of all the fillets, and joint them on as in Fig. 81. Put by to set for twenty-four hours. It will be seen in Fig. 86 that the front legs are let sidewise into the body as well as mortised.

Then place in the vice as in Fig. 81, and with a sharp axe boldly hack out the rough shape of the horse body. In axeing the fillets, chop down at the part where it rests on the body in all cases. Now with the draw-knife "pull" the body into shape, and if a pattern has been obtained, it will be a fairly easy matter to follow the design. When shaped, run all over with a spokeshave, and then finish with a rasp, leaving the body rough all over. Bore a ½-in. hole for the tail, and the horse is ready for painting.

On the top of the neck and a little to one side, with a gouge run a channel to take the mane.

For the rockers, make a pattern of thin wood, as in the case of the horse. They are to be cut out of four pieces of birch ¾ in. thick. Plane all over, and joint at C and D (Fig. 79). Now shape two pieces of wood (spruce will do) as in Fig. 12, and nail on to the rockers, one on each side, 4½ in. away from the centre. This roughly completes the rocker. Now obtain two pieces of dowel or turned wood about 1¼ in. in diameter and 5¼ in. long, and nail between the ends of the rocker at A. Then with some ½-in. pieces of spruce, 1½ in. wide, nail on to the floor of the rocker as at B, to make up a width of 9 in. This secures the rocker in position and makes it firm. The reason narrow pieces are used is that they shape to the rocker. Give two coats of green paint and varnish, and the rocker is finished.

Painting and Completing a Rocking Horse. — In painting the horse, first glue a small piece of cloth (butcher's muslin will do) over the leg joints, and allow to dry. Then run a thin coat of warm glue size over the whole, and allow to dry; this will leave the horse rough and apparently brittle. Get a small piece of board, and on it place a small quantity of plaster of Paris. The glue-pot (with thin glue) should be ready, and with a palette knife mix sufficient at a time to run into all the joints. Work it well in, so that the joints are completely covered, but not thickly. Next prepare a wash of very thin glue and whiting and plaster of Paris (2 parts of the former to 1 part of the latter), and run all over the horse and legs, smoothing down with a brush. When dry put on the next

coat (same mixture as last, but considerably thicker) and smooth. When this is dry the horse should look thoroughly covered, with no joints showing. To test the work tap at the plaster, and try and chip some off. If it does come off, the work has not been done thoroughly.

Now glasspaper all over the horse until it resembles polished marble. The joints must not show at the neck and legs.

The horse should now be dusted, and painted with bold sweeps from the neck downwards and round the body. A 1½-in. or 2-in. flat brush is best for this, and the paint should be an oil paint, bought ready mixed. Ask for ivory white with a slight tinge of blue in it. Two coats may be necessary; allow twenty-four hours to dry.

Then procure a small quantity of vegetable black and a 1-in. sash tool. On a saucer or tin lid mix a small quantity of the black with some thin glue, and dapple the horse in rings in the same way as may be seen on the purchased article. When dry the horse can be varnished and allowed to stand until quite hard. The varnish used for this must be quite white; in the trade it is known as extra white varnish, and must be free from any colour. Next with a little red paint the ears, the inside of the nostrils, and the inside of the mouth. This paint should have a little varnish mixed with it. With a thin lining brush paint round the eyes, and put some thin strokes to imitate the hair. If glass eyes are being put in the horse (usual in this size), a small hole should be gouged out previous to painting on each side of the face, and two eyes procured from the local taxidermist. These are placed in the

sockets after first putting in a small quantity of plaster of Paris mixed with water.

For the hair, obtain from a local butcher two cows' tails, quite fresh. Clean thoroughly, and with a sharp knife split the skin open to the root, and remove this root. Pare off as much skin as possible, and then lay inside a paste made of 3 parts of alum and 1 part of salt, roll up (skin inwards), and allow to remain so for a day or so. When ready shake out the alum, etc., and the hair should be quite firm. Use one for the tail and one for the mane, both, of course, being the same colour. It will be necessary to cut away a lot of skin, leaving just sufficient to allow it being forced into the neck channel and tacked there. The tail skin should be folded tube shape and forced into a hole, and a small wooden wedge driven in to fasten it there.

From a saddler and harness-maker procure the necessary leather, etc., for fitting up the horse. This is fastened on with small gilt-headed pins.

When quite finished place the horse on the rockers, so that the insides of the hoofs just pass the top outside edge of the rockers. The horse should stand quite level. Now with assistance, to steady the toy, bore a ½-in. hole with a brace and bit right through the hoofs and the rocker, and fit in a ½-in. bolt and screw-on nut. This will complete the rocking horse.

A "New-style" Rocking Horse. — The foregoing instructions apply precisely to the making of a "new-style" rocking horse (see Fig. 87), except with regard to the stand and pillars. The horse is attached to two side rails in exactly the manner already described for attach-

ment to the rocker, and these rails are suspended by two iron hinges from a centre rail supported by two turned pillars, themselves mortised into a simple stand of the type illustrated. Suitable sizes are indicated in Fig. 87.

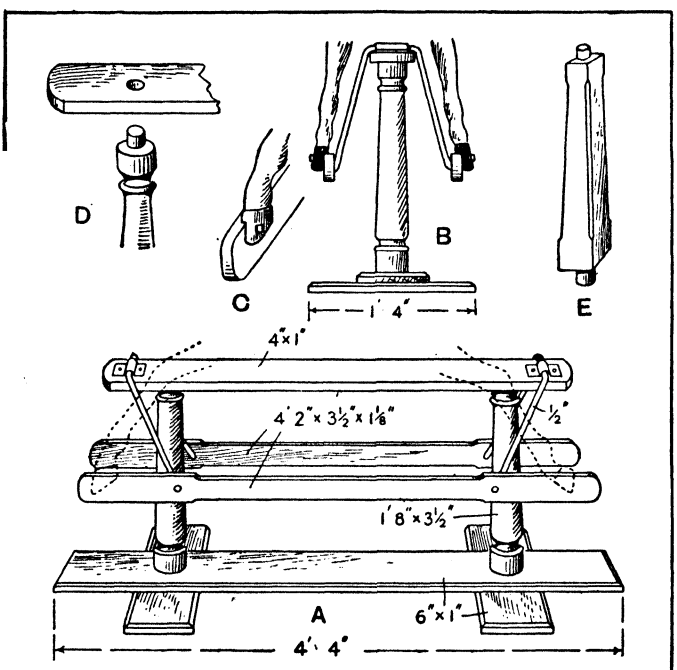


Fig. 87.—A "New-style" Rocking Horse.

The two iron hinges are of rod iron and ∩-shaped, their lower ends being bent and passed through the rails. The hinges are held in place by stout pieces of sheet metal. There are four sizes in the trade, Nos. 1 and 4 being respectively 27½ in. and 40½ in. high to saddle, while the stands are 36½ in. and 57½ in. long.

CHAPTER X

Wooden Motor Cars and Engines

Motor Wagon.—Fig. 88 shows a toy tipping motor wagon; details of the construction are given in Figs. 89, 90 and 91. It consists of an under-carriage to which is hinged the wagon body. A small wire hasp on the front of the body engages with a crew-eye in the seat to keep the body from tipping when not required to do so.

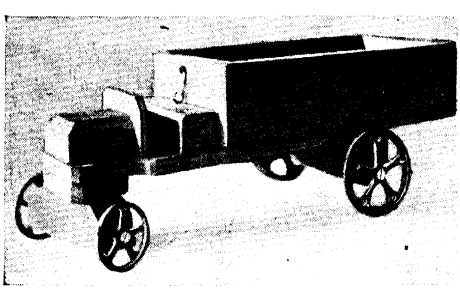
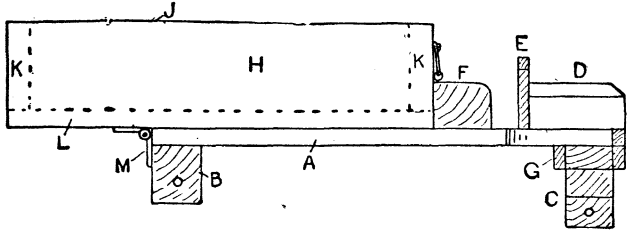


Fig. 88.—Motor Wagon.

The following gives the principal measurements, the same letter being used to indicate the same part throughout the illustrations: The carriage base A is 10 in. long, 4 in. wide, and $\frac{3}{8}$ in. thick; the axles B and C are 5 in. long, $1\frac{1}{4}$ in. wide, and 1 in. thick; the bonnet D i 2 in. long, 2 in. wide, and 1 in. thick; the footboard E is 3 in. long, $1\frac{1}{2}$ in. wide, and $\frac{1}{4}$ in. thick; the seat F is 4 in. long, $1\frac{1}{4}$ in. wide, and 1 in. thick; the packing piece G is 3 in. long,



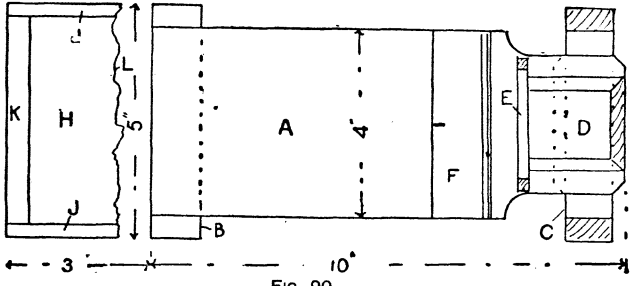


FIG. 90

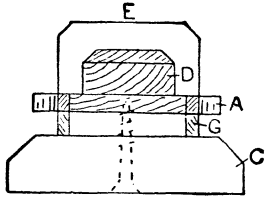


FIG 91

Figs. 89 to 91.—Elevations and Plan of Motor Wagon.

1½ in. wide, and ½ in. thick; the body H is 9 in. long, 5 in. wide, and 2¼ in. deep; the sides J are 9 in. long, 2¼ in. wide, and ¼ in. thick; the ends K are 4½ in. long, 1⅞ in. wide, and ½ in. thick; the bottom L is 9 in. long, 4½ in. wide, and ⅜ in. thick; and the hinge M is 2½ in. long.

The rear wheels are 2½ in. and the front wheels 1¾ in. in diameter. A wire staple driven into the front axle forms a suitable attachment for the hauling cord. The kind of wood used, the degree of finish imparted, and the actual shape of the various parts will depend on whether it is intended for home use or for sale, and in the latter case the price at which it is to be sold must be left to individual workers.

Those making it for home use may add a few refinements, according to their fancy; but those making the toy for sale may wish to simplify it still more. For instance, the pivoted front axle might be dispensed with and a fixed one substituted. The four wheels might be of the same diameter and the packing piece G omitted, and likewise the shaping of the carriage where the bonnet rests. The sides of the body and the footboard of the original are of three-ply wood for strength; but cheaper wood might be substituted. Of course, in making the wagon for sale, the various parts will be planed to the required section in long lengths and sawn off as required.

Motor Cab.—A toy motor cab is shown by Fig. 92, and the details of construction are given in the following figures, where Fig. 93 shows the side elevation with the front side of the cab removed, Fig. 94 a plan with the top removed and the position of the sides shown in dotted

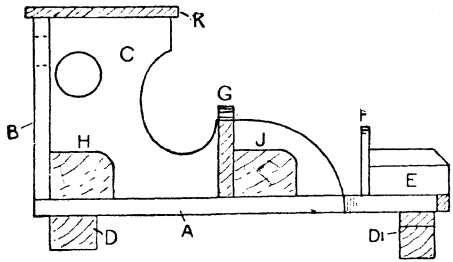


FIG. 93

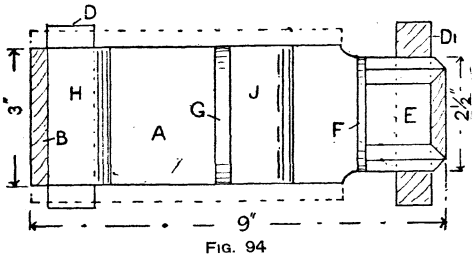


FIG. 94

Figs. 93 and 94.—Elevation and Plan of Motor Cab.

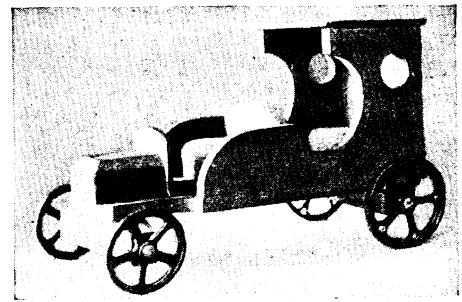


Fig. 92.—Motor Cab.

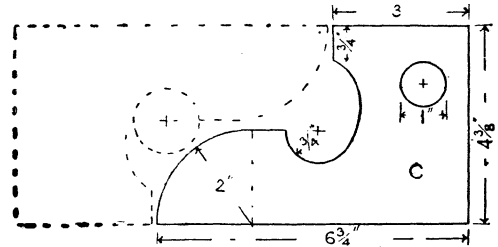


Fig. 96.—Setting out Side of Cab.

lines, Fig. 95 a front elevation, and Fig. 96 gives the setting out of a side and shows how the two sides can be set out to save wood.

The following are the principal measurements of the various parts, each part bearing the same letter throughout the illustrations: The base A is 9 in. long, 3 in. wide, and $\frac{3}{8}$ in. thick; the back B is 4 in. long, 3 in. wide, and $\frac{3}{8}$ in. thick; the sides C are $6\frac{3}{4}$ in. long, $4\frac{3}{8}$ in. wide, and $\frac{3}{8}$ in. thick; the axles D and D^1 are 4 in. long, 1 in. wide, and $\frac{3}{4}$ in. thick; the bonnet E is $1\frac{3}{4}$ in. long, 2 in. wide, and 1 in. thick; the footboard F is $2\frac{1}{2}$ in. long, $1\frac{1}{2}$ in. wide, and $\frac{1}{4}$ in. thick; the seat back G is 3 in. long, 2 in wide, and $\frac{3}{8}$ in. thick; the seats H and J are 3 in. long, $1\frac{3}{8}$ in. wide, and 1 in. thick; and the roof K is 4 in. long, $3\frac{1}{4}$ in. wide, and $\frac{3}{16}$ in. or $\frac{1}{4}$ in. thick.

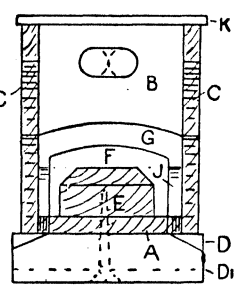


Fig. 95.—Front Elevation of Motor Cab.

The rear wheels are $2\frac{1}{2}$ in. and the front wheels $1\frac{3}{4}$ in. in diameter. The front axle is pivoted, and a wire staple driven into the front of this affords a means of attaching a cord.

The assembling of the various parts might be in the following order: Nail the back to the seat H, the back G to the seat J, and the footboard F to the bonnet. Then fix the back and its seat to the base, the axle D^1, the seat J, and the bonnet E in their places. Next the side and roof, and lastly pivot the front axle and fix the wheels. Round-headed screws for fixing the axles look very well; but

for competitive articles 1¼-in. or 1½-in. stout wire nails will answer.

The sizes of the axles and seats of the motor cab and the motor wagon vary in width or in thickness; but anyone making the two articles for sale can easily arrange for them to be of similar width and thickness.

The inside of the cab should be stained or painted before fitting the parts together.

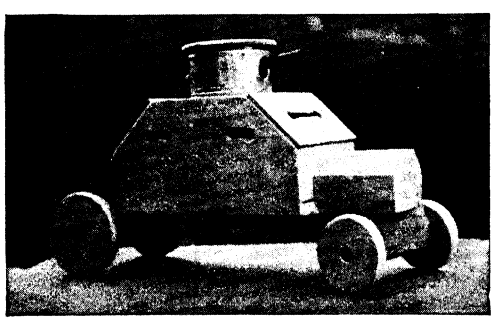


Fig. 97.—Armoured Motor Car.

Armoured Motor Car. — Fig. 97 shows a simple armoured car with a revolving gun-turret. In the side elevation (Fig. 98) the front of the body and the nearest wheels have been removed, and in the plan (Fig. 100) the wheels and the lid of the gun-turret have been removed. In the front elevation (Fig. 99) only the front portion of the car is shown. The look-out slit is shown true shape, the turret (minus gun) and screw are shown in section, and the wheels are not shown. The setting out of one side of the car is shown in Fig. 101. Each part bears the same letter throughout the illustrations.

The base A is 11 in. long, 4 in. wide and $\frac{3}{8}$ in. thick, reduced at each end as shown in Fig. 100. The sides B are $6\frac{1}{2}$ in. long, $3\frac{1}{2}$ in. wide, and $\frac{3}{16}$ in. thick, shaped as

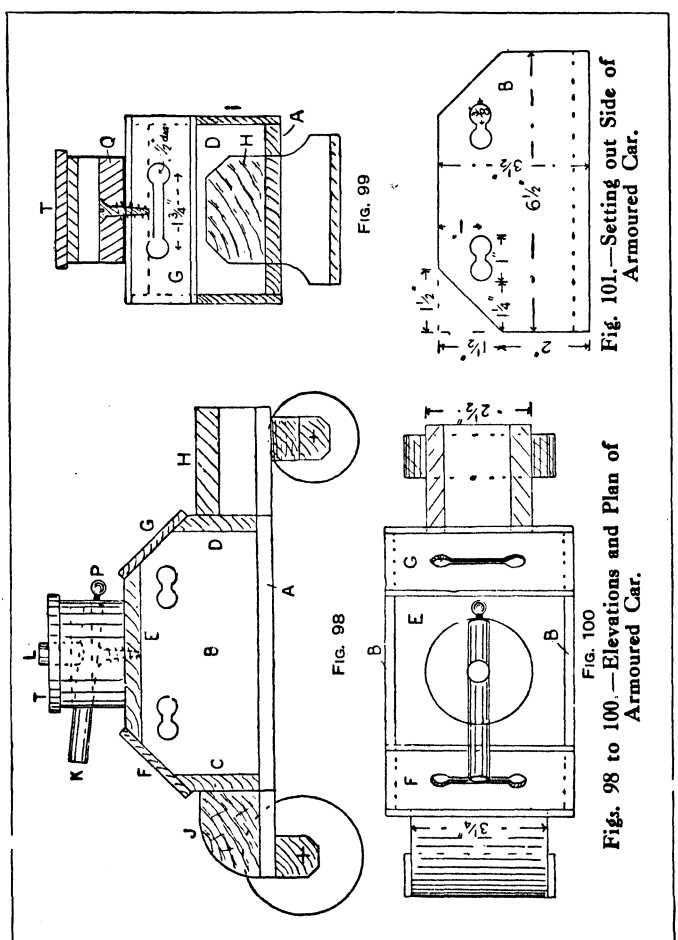


Fig. 101.—Setting out Side of Armoured Car.

Figs. 98 to 100.—Elevations and Plan of Armoured Car.

shown in Fig. 101, where the dotted line shows the position of the base. The three pieces of wood C, D, and E are all 4 in. long, and $\frac{3}{8}$ in. thick, C and D being 2 in. wide and E $3\frac{1}{2}$ in.

It will be as well to plane the bevels after nailing these pieces to the sides. The two pieces F and G are of $\frac{3}{16}$-in. three-ply, and can be either nailed or hinged. Both axles are $3\frac{1}{2}$ in. long and 1 in. wide, the front one being $1\frac{3}{8}$ in. deep, and the rear one 1 in. deep. The latter is nailed to the base, and the former swivels on a 2-in. No. 12 screw. The bonnet H and rear-piece J are $1\frac{1}{2}$ in. thick. The wooden wheels may be $\frac{3}{8}$ in. or $\frac{1}{2}$ in. thick. The rear wheels are 3 in. and the front wheels 2 in. in diameter. Four holes might be bored in each wheel to give them a lighter appearance, and they can be fixed with No. 10 $1\frac{1}{4}$ in. screws.

The gun and turret are shown in plan by Fig. 102 and in section by Fig. 103 (spring and lid excepted). The gun is made from two pieces of brass tube of an internal diameter of $\frac{3}{8}$ in., one piece, K being 4 in. long, and the other, L, $1\frac{1}{4}$ in. long. A $\frac{3}{8}$-in. hole is bored in the long piece $1\frac{1}{4}$ in. from one end, and one end of the short piece is filed out to a curve to fit over this hole with a slight forward tilt as shown in Fig. 103. The two are now soldered together. It will facilitate soldering and make sure that the bore of L is exactly over the hole if a short piece of $\frac{3}{8}$-in. dowel rod is pushed through the short tube and into the hole while soldering. A thick washer M, having a $\frac{1}{8}$-in. central hole, is soldered in the end of the tube for the spring to bear against. The spiral spring is about $\frac{1}{4}$ in. in diameter and

2 in. long. To compress it, a stout washer N is soldered to the end of the wire O, and a knob of some kind P is soldered on the other end of the wire. When compressed, the spring should leave the opening of the tube L clear, as it is intended to feed peas (the ammunition) through this tube.

The turret is a tobacco tin 2½ in. in diameter and 1⅝ in. deep; or any tin of suitable diameter can be cut down for

Fig. 102.—Plan of Gun and Turret.

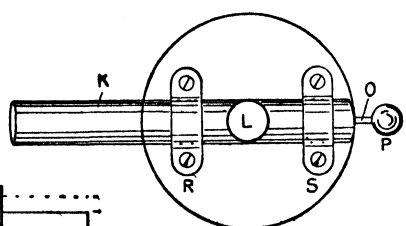


FIG. 102

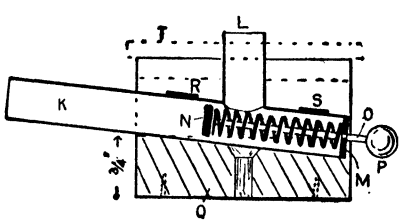


FIG. 103

Fig. 103.—Section through Gun and Turret.

this. In the bottom of the tin is placed a disc of wood Q, ¾ in. thick, having a groove cut in it to give the gun an upward tilt, so as to ensure that the peas drop towards the spring when charging. In the centre of the disc a hole is bored and countersunk to take a stout screw, on which the turret pivots. Three holes are cut in the tin, one to take the pivot screw, one to take the barrel of the gun, and one to accommodate the wire O. (The soldering on of the knob P might be left until the gun is fixed.) The cutting of the hole for the barrel was done with an old

carving gouge and on the end grain of the disc Q. Two or three sprigs, driven through the bottom of the tin, will hold the disc in position.

The turret can now be fixed by the central screw, and the gun mounted in position and secured by two straps R and S. A lid T can be made from two discs of thin wood glued together, and the toy is complete.

It was suggested that the two pieces of wood F and G might be nailed or hinged. The idea of hingeing these was that the inside might be fitted up to accommodate toy soldiers. If they were fixed, and the body secured to the base by screws (and free from the blocks J and H) so as to be easily removable, the car might be used as a collecting box at charitable bazaars, say, one shot a penny.

Simple Wooden Engine.—A toy engine on regulation lines is shown by Fig. 104. The body or boiler needs to be turned, and afterwards planed flat underneath to the depth of ½ in., so as to rest on the baseboard (Fig. 105). The openings at the side, shown on one end of the baseboard, are for pieces forming the sides in which the tender will fit. Underneath the baseboard are fitted three cross-pieces, as shown by dotted lines, to which the baseboard is nailed. Fix the baseboard to the body with screws. Then nail on the piece forming part of the cover (Fig. 107) to the end of the body, the sides of cover (Fig. 108), and the top. Next nail on the sides of the tender in the openings cut to receive them, and fix the end of the tender between the sides. Nail on the side pieces (Fig. 106) and buffer planks (Fig. 109). The holes shown in the buffer planks are for receiving the buffers, which should be

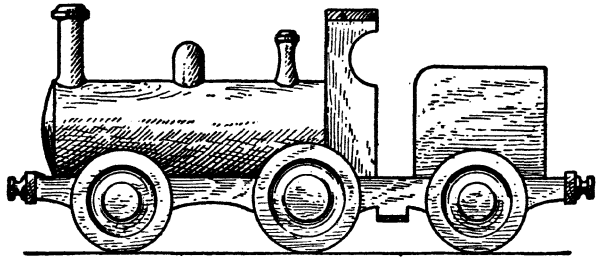


Fig. 104.—Wooden Engine.

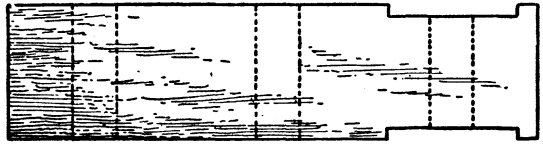
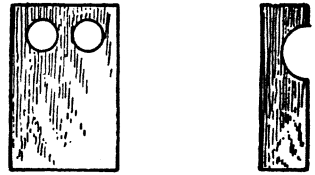


Fig. 105.—Baseboard.

Fig. 106.—Side of Engine.



Figs. 107 and 108.—End and Side of Cover.

Fig. 109.—Plan of Buffer Plank.

Fig. 110.—Section through Wheel.

glued in. The buffers, also the chimneys and dome, should have dowels turned on them.

Fix on the wheels (see section, Fig. 110) with 3-in. by ¼-in. coach screws, and put iron washers at both sides of the wheel. The centre wheels are ¼ in. larger in diameter than the others, which allows for the engine turning round quicker. In the centres of the buffer planks screw two large picture rings, to which can be attached a cord for hauling.

Bore holes in the top of the boiler for fixing the chimneys and dome, and file them to fit snug on the boiler. The engine is then ready for painting and lettering, using one or more colours as desired.

The following are the measurements of the pieces required: Body or boiler, 1 ft. 1 in. long and 4¾ in. in diameter (Fig. 104); baseboard (Fig. 105), 2 ft. by 6 in. by ¾ in.; end part of the cover (Fig. 107), 7½ in. by 5 in. by ½ in.; two sides for the cover (Fig. 108), 7½ in. by 2½ in. by ½ in.; one piece for the top of the cover, 6 in. by 2½ in. by ½ in.; two sides for the tender, 6 in. by 6 in. by ½ in.; one end for the tender, 5 in. by 5½ in. by ½ in.; two side pieces (Fig. 106), 2 ft. long by 2 in. by ½ in.; two buffer planks (Fig. 109), 7 in. by 1½ in. by ½ in.; three cross-pieces for underneath the baseboard, 6 in. by 2 in. by 2 in.; four pieces for the buffers, 1½ in. by 1¼ in. by 1¼ in.; one piece for the chimney, 3¾ in. by 1¾ in. by 1¾ in., and another piece 2½ in. by 1 in. by 1 in.; one piece for the dome, 2½ in. by 1¾ in. by 1¾ in.; two wheels, 4¾ in. in diameter by ¾ in. thick; and four wheels, 4½ in. in diameter by ¾ in. thick.

CHAPTER XI

A Shilling Camera

THE toy camera described in this chapter is of the "pin-hole" type, has no glass lens, and is made strongly of wood, so that it will last, it takes four photographs on one plate without changing, and it can be made to sell at one shilling provided that a good number be made at one time. The camera is made chiefly from three-ply wood, and as the sizes required are very small, the cost of the necessary wood amounts to very little, even for a number of cameras.

The camera complete, with the plate entirely screened from light, is shown by Fig. 111. Fig. 112 shows the exposure being made, and Fig. 113 shows the camera taken apart for loading, and also gives an idea as to how it is made.

The part to the left of Fig. 113 is a plain box 4 in. deep by 3¼ in. square on the inside. Each of the four sides of this box has a saw kerf cut across the middle to the depth of ⅛ in., as shown. The part to the right of Fig. 113 shows the inner fittings. The central stem (⅜ in. in diameter only) is kerfed in four places, so that one kerf on this will be opposite each of those in the other part, and when the four pieces of cardboard shown are fitted, they will slide inside the box and divide it into four equal parts. The central stem fits into a hole in a somewhat thick

piece of wood cut to the right size so as to fit in the end of the box, and this thick piece is kerfed as shown to take the pieces of cardboard, and also bored in what is really the middle of each of the four divisions into which the camera is divided. These holes are clearly shown, and their object will appear later. To prevent the light from entering at the sides of the thick perforated piece, a thin piece is fixed to this, the edges projecting all round so as to finish level with the outside of the camera. The four holes must be continued through this thin piece also.

Fig. 114 shows the two parts of the camera partly put together, and the thick as well as the thin piece can be plainly seen. Yet another piece of three-ply is required. This should be $\frac{3}{16}$ in. or even $\frac{1}{4}$ in. thick; it is pivoted in the middle with a round-headed screw as shown, so that it will turn completely round as desired, and must be sufficiently tight to stay in any place where it is left. This latter piece must have a hole some $\frac{3}{4}$ in. in diameter bored partly through from the inside, and finished as a $\frac{1}{4}$-in. hole on the outside, and in this hole is fixed the "lens." This latter is simply a piece of cardboard in which is made a small, clean hole with a needle. It is absolutely necessary that the hole be cleanly bored, and the roughness at the back should be gently rubbed away.

Fig. 115 shows the inside of the front of the camera with the "lens" in position, also the inside view of the round stem and the thick front which carries the cardboard divisions. Fig. 116 shows the outside of the same two parts.

The action of the camera is as follows: The front

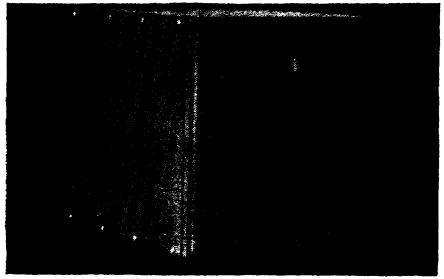


Fig. 111.—A Shilling Camera.

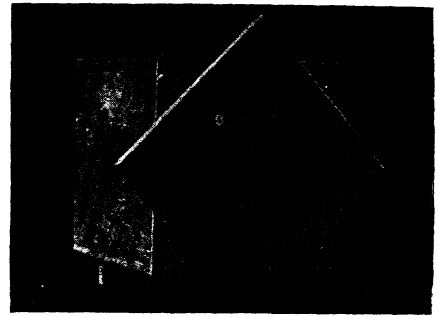


Fig. 112.—Plate being Exposed.

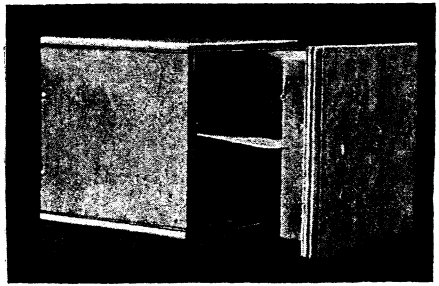


Fig. 114.—Camera partly put together.

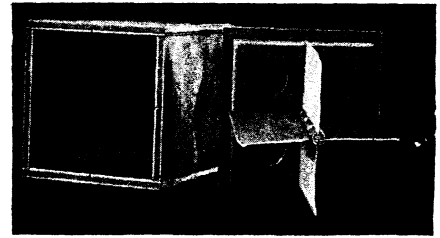


Fig. 113.—Two Parts of Camera (Inside View).

of the camera is drawn out entirely, and a photographic plate 3¼ in. square dropped into the box part sensitive side upwards; the front part is then replaced, and the camera can be taken anywhere, the plate being safely

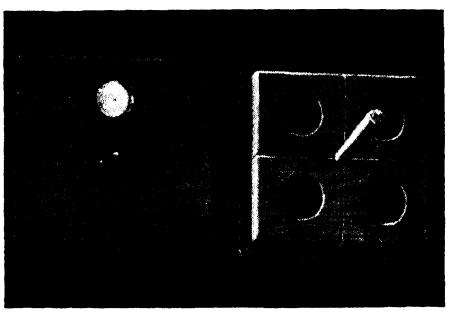


Fig. 115.—Inside View of Camera Front Proper and Inner Front.

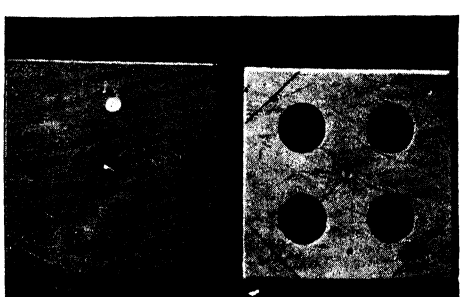


Fig. 116.—Outside View of Front Proper and Inner Front.

shielded from light. The plate must be put in position and the front replaced in the dark or by red light only.

To expose, place the camera opposite the subject and turn the front so that the "lens" comes opposite one of the openings in the inner front. Lines showing

when the position is correct can be made as in Fig. 116, these being marked by the actual front itself when placed experimentally at 45° to the body of the camera. Numbers must also be placed so that there is no risk of exposing the same portion of the plate twice.

The exposures in a camera of this kind are of course fairly long; but, given suitable subjects, very fair results can be obtained. No focusing is required; no matter what is taken it will always be in focus. The smaller the pin-hole forming the "lens" the better will be the detail, and at the same time the longer will be the exposure required.

In making several of these cameras a good number of pieces of wood will be wanted of the same size, and the appliance shown in Fig. 117 will be found convenient for cutting up these without the need of any marking or setting out. This consists of a base about 20 in. by 12 in., and on this is fixed the front piece running the whole width and 3 in. wide. Another piece is fixed at the front right-hand side, the two being at true right angles one to the other. The narrower piece shown is screwed to the base, parallel with the edges of the same, and the cross-piece shown on it is made to slide to and fro along it, being fitted tight enough to stay in any position. A saw-cut as shown is made in the front piece and also in the sliding piece, not taking it quite through the latter, or it will fall in two. Now by placing a stop block of suitable thickness against the right-hand front piece, as many pieces as required may be cut exactly alike, using the sliding piece and the saw as in Fig. 118.

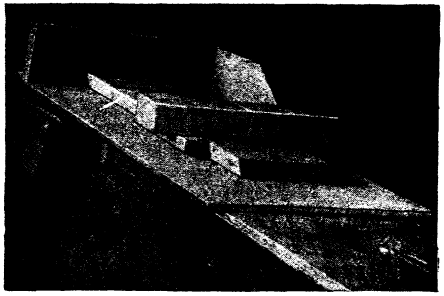


Fig. 117.—Cutting and Shaping Appliance.

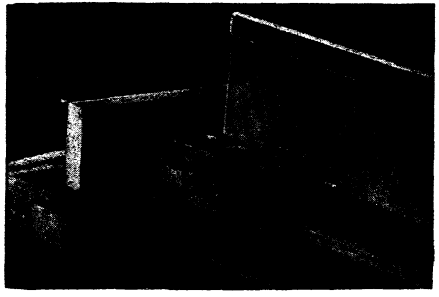


Fig. 120.—Kerfing Inner Front (Cross-Kerfs)

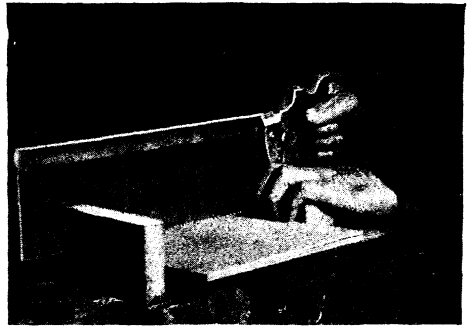


Fig. 118.—Cutting up Boards for Camera.

Fig. 119.—Kerfing Central Stem in Long Length.

The round stems can also be kerfed in this appliance, Fig. 119 showing the kerfing of a piece of ⅜-in. dowel rod long enough to make three stems. Fig. 120 shows the inner thick front being cross-kerfed. This appliance will be found useful in many ways.

Before the parts of the camera are fixed together permanently, those which come on the inside must be blacked with some kind of dead black (lamp black with just enough french polish to bind it without giving any gloss), as if this is not done the light-coloured wood will be likely to reflect the light and fog the plate. The outside of the camera may be blacked, or it may be stained and varnished at one operation, or it may be covered with imitation leather; but the latter could not be done on a shilling article.

CHAPTER XII

A Working Crane

FIG. 121 is a reproduced photograph of the crane, but differs in small details from the one to be described.

The wheels are about 2 in. in diameter, and may be of wood or metal. They are fixed to pieces of wood 6¼ in. long by ⅞ in. thick and about 1 in. deep by means of round-headed screws. These pieces of wood are fixed to the frame with screws. This method of fixing allows of slight adjustment if, on trial, all the wheels do not run on the ground.

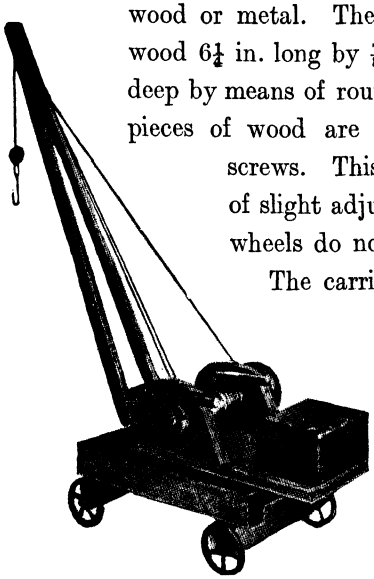


Fig. 121.—Toy Working Crane.

The carriage frame is 10 in. long and 6 in. wide, and made of wood ⅞ in. square, fixed together with mortise-and-tenon joints. A piece of wood ⅜ in. thick is fixed on the top of this frame. The buffers are fixed to the frame with screws. A piece of wood A (Fig. 122) is glued under the top to receive the screw on which the body of the crane turns.

The base B of the body of the crane is 12 in. long, 4¾ in. wide, and ½ in. thick. The uprights C are screwed to this,

and a circular piece of wood D, like a large washer, 4¾ in. in diameter, is glued underneath. The under side of this washer is blackleaded. A large round-headed screw about $\frac{5}{16}$ in. in diameter forms the pivot on which the body turns. This screw passes easily through the base, and obtains a firm hold in A. A large washer (the circular plate of a broken castor does admirably) goes under the pivot head, and is screwed to the base.

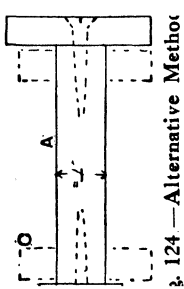


Fig. 124.—Alternative Method of Forming Drum.

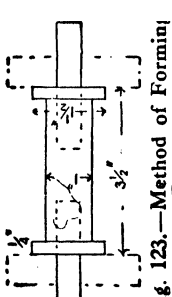


Fig. 123.—Method of Forming Drum.

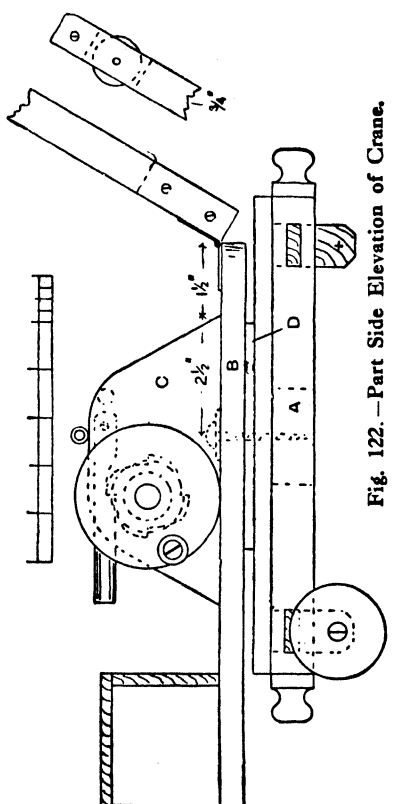


Fig. 122.—Part Side Elevation of Crane.

The drum is 3½ in. long and 1 in. thick and 1½ in. over the flanges. The axle part is ½ in. thick, and is a nice easy fit in the uprights. A small hole E (Fig. 125) is bored through the drum to take the hauling cord. Those who do not possess a lathe might build up the drum as shown in Fig. 123. Another method is shown in Fig. 124, where A represents the drum, B the handwheel, C the upright, and D the ratchet. The uprights C are ⅝ in. thick, and the setting out of these parts is shown in Fig. 126.

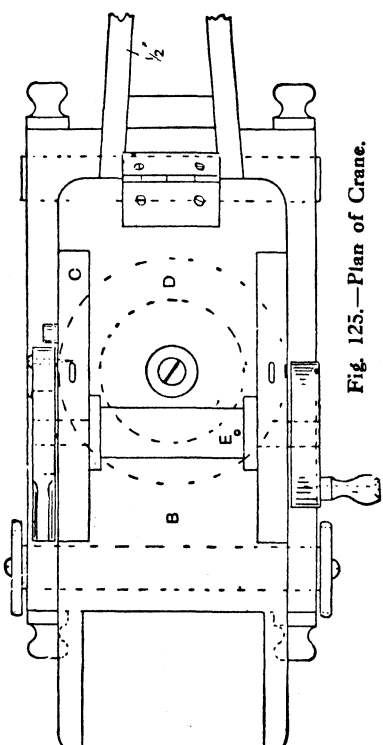


Fig. 125.—Plan of Crane.

The handwheel is 3 in. in diameter and ⅝ in. thick. It fits tightly on the axle, and is secured with a little thin glue. The handle is 1¼ in. long and turns on the screw.

The ratchet wheel is 1¾ in. in diameter

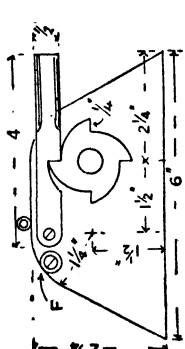


Fig. 126.—Side of Crane showing Ratchet and Pawl.

and ½ in. thick with teeth ¼ in. deep. Beech is a good wood for this. Before fixing it with glue, see that it is put on the right way. The pawl may be of beech or boxwood 4 in. long and ½ in. square. A small stop F (Fig. 126) prevents the pawl going too far back when the drum is released.

The jib is 1 ft. 9 in. long, oak being a good material to use. The sides are ⅝ in. wide and ½ in. thick, screwed and glued to G and H (Fig. 127). To assist in setting out the jib a full-size drawing might be made, or the angles may be obtained as shown in Fig. 128. Square a line across a board, take 5¼ in. along this and ¼ in. along the edge of the board, and join the two points. The piece G can be then set out with the bevel, and the piece H fitted after the sides have been screwed to G. A hole is mortised for a small grooved pulley about 1 in. in diameter, and a screw-eye fitted where shown. The jib is hinged to the base, and held at a suitable angle by a cord, passing from an eye on one upright, through the eye in the jib, and secured to the eye on the other upright.

The ballast box, 3¾ in. by 3 in. by 2½ in., is made of ¼-in. wood and screwed to the base. Pieces of iron or lead are used as ballast; about 1½ lb. or 2 lb. will be required. The amount will be determined by trial. A fine strong cord, like whipcord, with a ball and hook attached, completes the crane.

The choice of wood is left to the maker, but the following may be helpful: Carriage and jib of oak, body of walnut or mahogany, and drum of a light wood, as

sycamore. All wheels and ironwork to be painted black.

One or two additions may be added if desired. A lever somewhat like the pawl may be fixed inside the upright next to the hand-wheel to form a brake. A

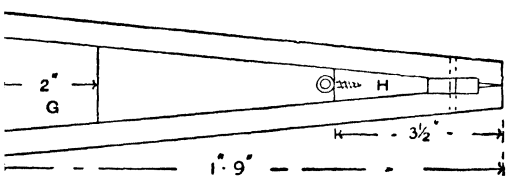


Fig. 127.—Method of Setting out Jib.

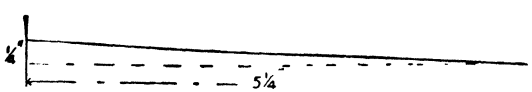


Fig. 128.—Method of Obtaining Slope of Sides.

second drum may be added if the uprights are made about 1½ in. longer and the pawls made slightly shorter. The new ratchet will be alongside the present hand-wheel, and the pawl handle pointing forwards. The forward drum can be used for lifting, and the back one for raising and lowering the jib.

CHAPTER XIII

A Pair of Scales

A PAIR of toy scales is shown in Fig. 129, and when well made forms a very substantial toy. An incomplete plan (Fig. 131) gives the setting out of the base, which is $\frac{3}{8}$ in. thick, and the positions of the beam, pillar, foot, and

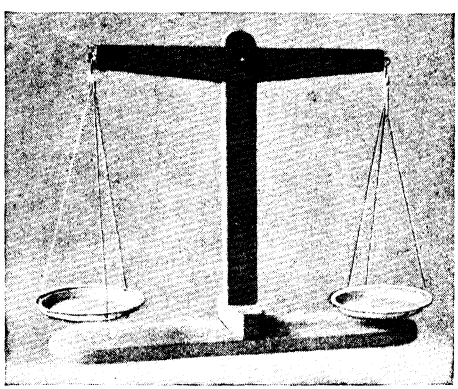


Fig. 129.—Pair of Scales.

scale-pans. The beam is 1 in. wide at the centre and $\frac{1}{2}$ in. at each end, and is pivoted on a central screw, the hole for which is bushed with tin. A couple of screw-eyes or wire loops serve to suspend the scale-pans. Details of the joint for the pillar and foot are given in Fig. 132.

The scale-pans can be made from the lids of 2-lb. syrup tins. The three strings, each having a good-size

knot on the end, are threaded through the pan. The upper ends can then be gathered together, passed through the screw-eye, and folded over and whipped, along with the hanging part of the strings, with thread.

When turning the toy out in large numbers, some of the refinements mentioned would probably have to be

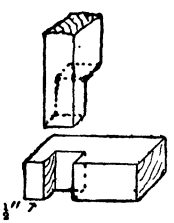


FIG 132

Fig. 132.—Joint for Pillar and Foot.

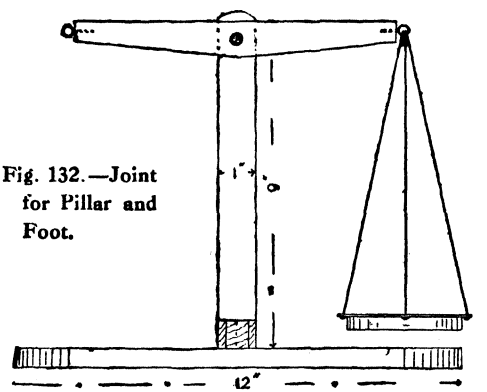


FIG. 130

Figs. 130 and 131.—Part Elevation and Part Plan of Pair of Scales.

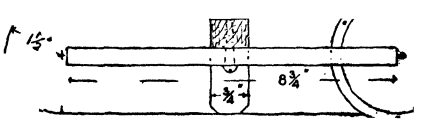


FIG. 131

sacrificed. For instance, the hole would not be bushed for the central screw, which might be replaced by a nail. The strings would not be whipped, but might be clasped with a strip of tin. The foot might be dispensed with by making the base thicker and cutting a mortise to take a barefaced tenon on the pillar, the opposite way of the wood to that shown in Fig. 132.

CHAPTER XIV

Freak Animals

THE animal shown in Fig. 133, and known by courtesy as a dog, is of a type introduced to the toy trade a few years ago. Legs, tail, ears, and "collar" are of wood $\frac{3}{8}$ in. thick, while the body, in a small animal, is of the shape and size indicated in Fig. 134. The collar is a square or

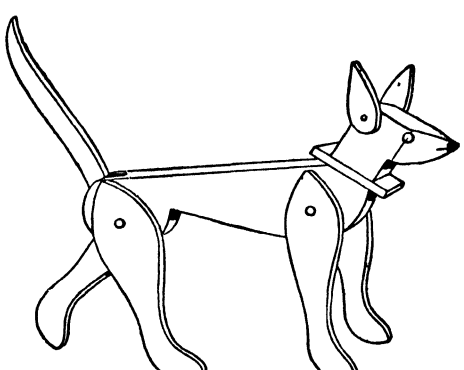


Fig. 133.—Freak Dog.

oblong piece of wood nailed on as in Fig. 135, the spike there shown being a wire nail driven through from the other side of the collar before attaching the latter to the body. The head is of the same thickness as the body, is given more or less of a canine appearance by means of saw and knife, and is attached by impaling it on the spike. The body is slotted, as shown in Fig. 134, to re-

ceive the tail, which, with the legs and ears, is secured with small wire nails; and they all, as well as the head,

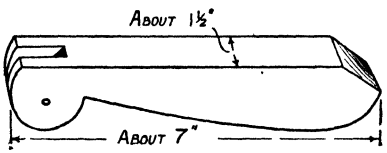


Fig. 134.—Body of Freak Dog.

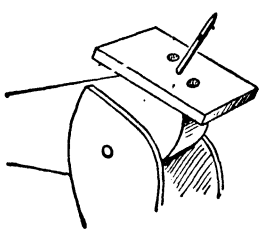


Fig. 135.—Dog "Collar."

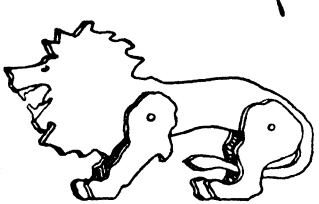


Fig. 136

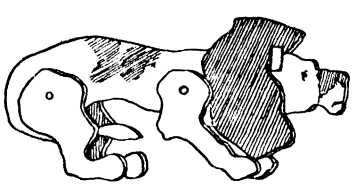


Fig. 137

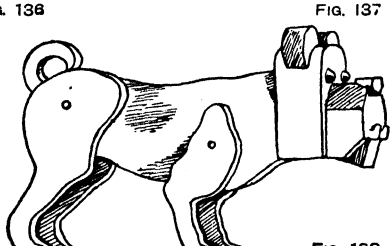


Fig. 138

Figs. 136 to 138.—Other Freak Dogs.

move a trifle stiffly. The eyes are dome-headed brass nails. This is but one design of a great many of the kind that has been introduced during recent years; others are presented by Figs. 136 to 138.

CHAPTER XV

Dolls' Houses

A DOLL'S house should not, of course, exhibit any crudeness of taste in colouring, etc., and if it be kept quite simple and conventional, it will be much easier to produce, stronger and more durable, and yet perfectly suited to its purpose.

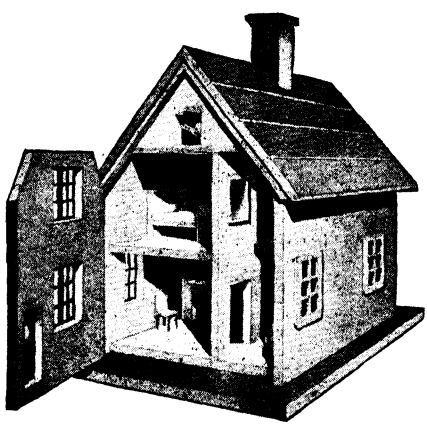
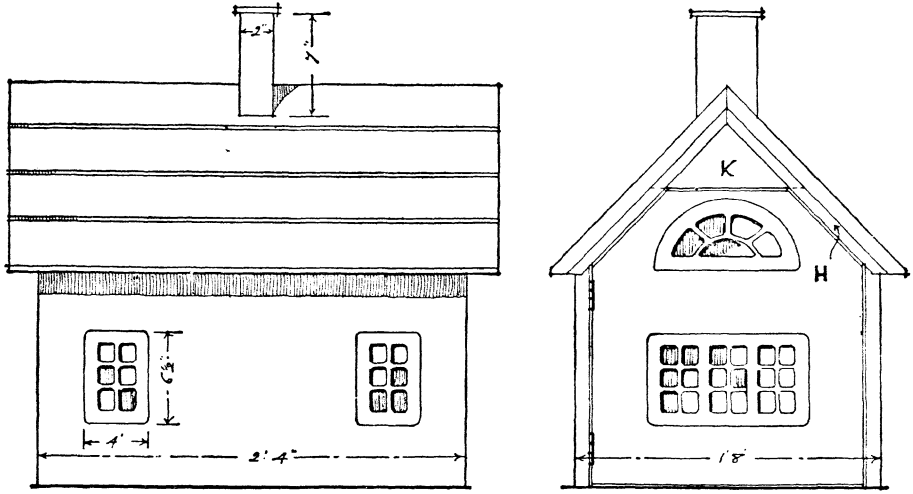
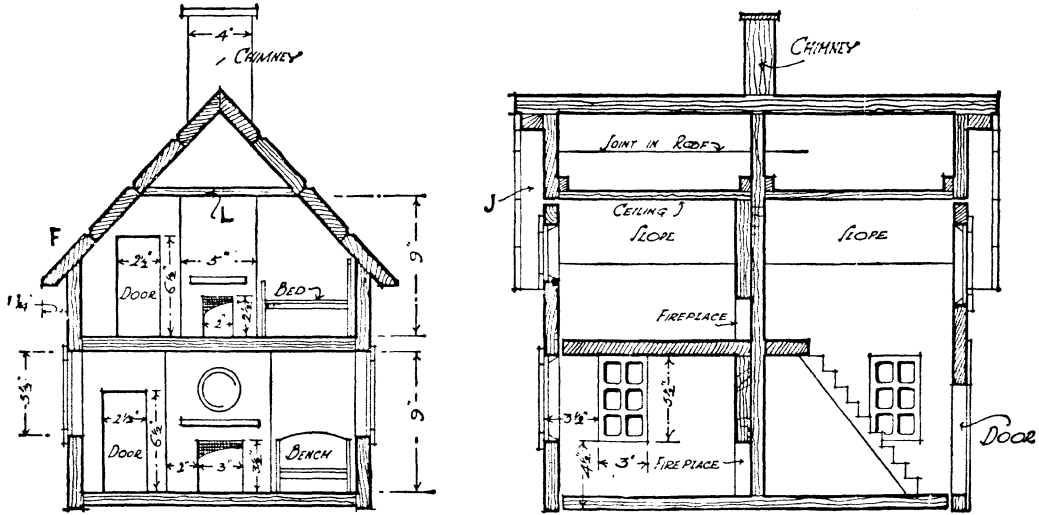


Fig 139.—View of Doll's House.

Figs. 139 to 144 illustrate a doll's house which consists on the entrance side of a small hall, giving access to a kitchen and a larger apartment, and furnished with a miniature staircase leading to two similar rooms above, all parts of the house being exposed at will by means of the hinged fronts indicated. As a matter of fact, all sorts of pieces and thicknesses can be used for the work; but



Figs. 140 and 141.—Elevations of Doll's House.



Figs. 142 and 143.—Vertical Section through Doll's House.

for the purposes of this description it will be assumed that the main sides and floor are of ¾-in. stuff, and the subsidiary portions ½ in. or less according to their positions. Fig. 145 gives a good general idea of the structure. It shows the base E, 1 ft. 6½ in. by 2 ft. 2½ in., with one of

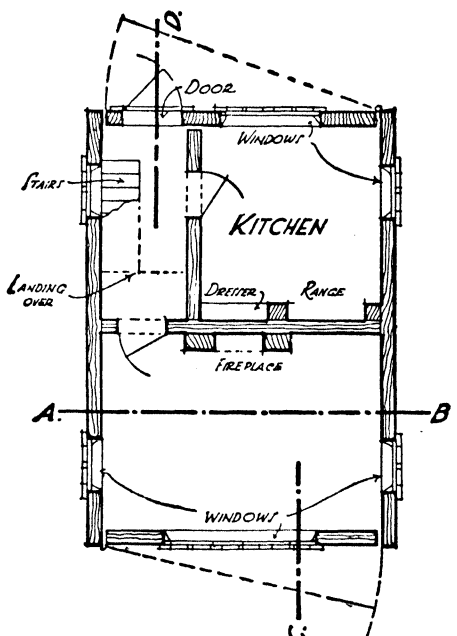


Fig. 144.—Downstairs Plan of Doll's House.

the sides fixed to its farther edge. This side is 2 ft. 4 in. long and 1 ft. 4 in. high, with its top edge splayed as at F in Fig. 142, and with two plain rectangular openings cut in it for the side windows seen in Fig. 140, the dimensions for which will be found in Fig. 144. Across the centre of E is fixed the middle partition-wall G, 1 ft. 3½ in.

high at its sides and rising to 2 ft. at the apex, having two doorways cut through it as in Fig. 145. These are either finished later with thin hinged doors or may be left quite open.

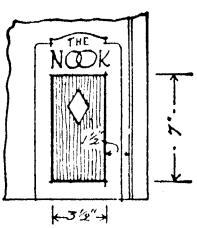


Fig. 148.—Front Door.

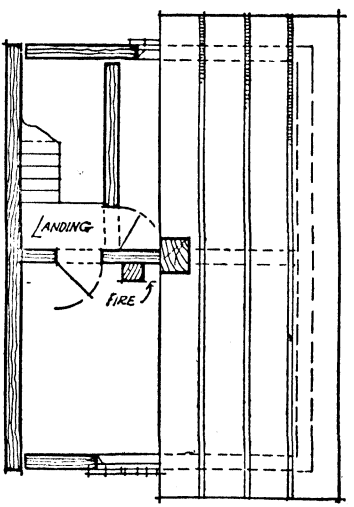


Fig. 147.—Part Upstairs and Roof Plans.

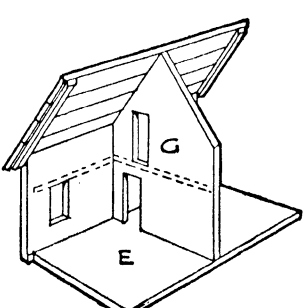


Fig. 145.—Internal Partition.

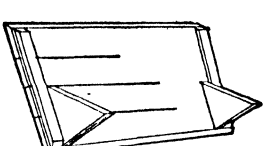


Fig. 146.—Part of Roof.

The roof is made up of several narrow widths, slightly chamfered off along their edges and splayed top and bottom, all as in Fig. 142, set out to overhang the sides and ends about 1¾ in., and held together with fillets 1¼ in.

by ½ in. square as at H in Fig. 141, J in Fig. 143, and shown in Figs. 145 and 146. In addition to these, the roof will require a triangular piece at each end, about 10 in. wide, as at K in Fig. 141, fixed just inside and tight against the fillets as in Fig. 146. These will help to hold the roof together; but in addition it will, of course, require very securely fixing to the sides and centre partition.

The next step might well be to insert the hall division, which is best seen in the view of the finished house (Fig. 139). This piece could be ½ in. thick, 1 ft. 6¾ in. high, with doorways cut out of it as in Figs. 142 and 145, fixed so as to form a hall 5½ in. wide and with its front edge agreeing with that of the base. Floors can then be fitted over both the rooms 9 in. up from the base; but in the case of the hall, only a small landing 5½ in. by 2¾ in. (Fig. 147), a flight of stairs without balustrading and chiselled out of a piece of 2½ in. by 1¼ in. and 12 in. long, being fixed as in Fig. 144.

A ceiling to the upper rooms, as at L in Fig. 142, is desirable, and it could be formed of three-ply level with the under side of the triangular pieces in the gables, fixed on small fillets. The spaces so formed might be approached by small loopholes and utilised as lairs for some small nursery toy (see the view of the finished house), or a bell could be arranged to ring there by means of a cord from the front door.

The fireplaces consist simply of pieces 1 in. thick, of the sizes shown in Fig. 142, with square openings cut out to suggest the grates, planted against the cross wall; that in the kitchen, perhaps, made large enough to fit a

toy range. Tiny mantelshelves and mirrors can be added, and also a few shelves to form a dresser, as shown in Fig. 144, if desired. The chimney is a solid block fitted over the ridge and finished with a thin flat piece projecting about $\frac{3}{16}$ in. all round the top.

The outline of the hinged ends can be gathered from

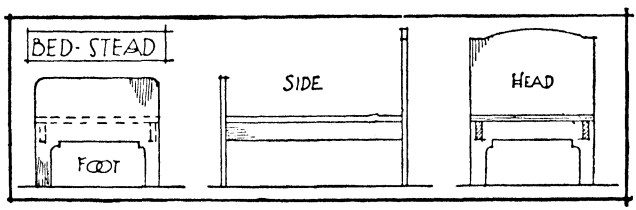


Fig. 149.—Doll's Bedstead.

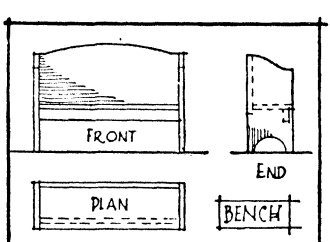


Fig. 150.—Doll's Bench or Settee.

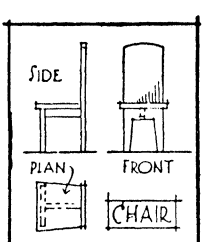


Fig. 151.—Doll's Chair.

Fig. 141, the arrangement of windows being quite optional, although a semicircular lunette as shown is sure to look well, and a door will be required at the other end as in Fig. 148. One of the small side windows is figured in detail in Figs. 140 and 144, and the remainder should follow on the same lines. A square opening is cut, and then a piece of stout fretwork, etc., prepared $\frac{1}{2}$ in. larger

all round, cut out to represent a series of small panes, preferably with rounded corners both for appearance and strength. The margin being $\frac{3}{4}$ in. wide, allows when applied an overlapping or rebate of $\frac{1}{4}$ in., into which the glass can be glued or puttied from the inside face, where the addition of a small pleated valance at the top will give quite a pleasing result. The hall door is also treated with an overlay cut to a simple design at the top, and this time finishing flush with the edges of the opening and perhaps inscribed with some simple name.

The external colours for the paintwork might be cream for the walls, with green windows and an indian-red roof; or some other combination such as a red roof, lead-grey walls, and white windows, and the internal decorations have unlimited possibilities. With a little ingenuity also many small pieces of furniture can be fashioned out of thin wood; three simple suggestions suitable for adoption with this doll's house will be found in Figs. 149 to 151.

Another Doll's House. — Fig. 152 shows a doll's house that has the appearance of a real dwelling-house on first observation.

The house is arranged on the following plan, and measures 3 ft. by 2 ft. over all, containing on the ground floor, entrance hall with staircase, sitting room (left side), kitchen (right side), and pantry formed under stairs. The upper floor contains staircase landing with a bedroom on each side. The house is made in two sections, the lower portion being 1 ft. deep from the floor to the ceiling, and the upper portion 10 in. deep from the bedroom to the ceiling or line of eaves. It thus enables the upper portion

at the bedroom floor level to be lifted off, and is lighter for moving about the room. The method for allowing the interior to be free of access for fitting up and using the rooms is obtained by means of double-hinged doors at the back, and in addition to this, all doors and windows

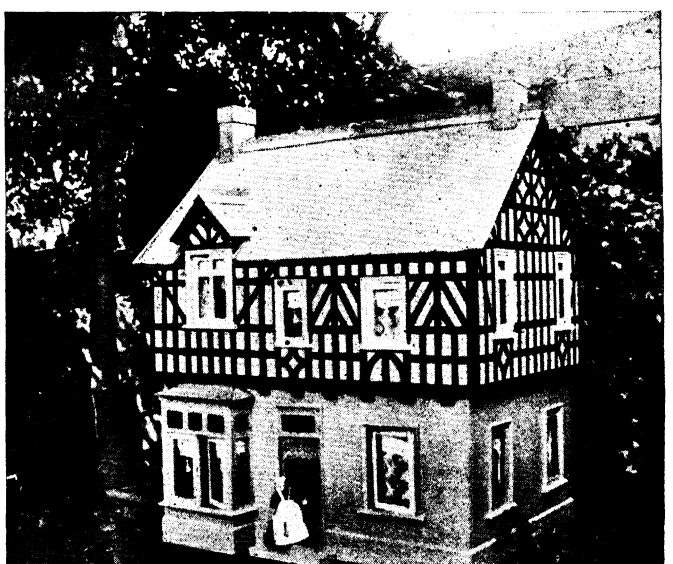


Fig. 152.—Realistic Doll's House.

in the front are made to open, as may be seen on reference to the illustration; in fact, the servant may be seen standing by the open entrance-hall door.

Dealing with the materials for building, all is imitation; the exterior is designed to give the appearance of a half-timbered house with stonework below and the roof of Bridgwater tiles. The main walls of the upper and lower

portion are constructed of American wood ½ in. thick, with inside partitions, ceiling and roof ¼ in. thick. It will be noted that the upper portion projects with corbels underneath, which gives it a quaint appearance. The lower story is painted a buff tint, jointed to imitate coursed and dressed stone, and the upper portion to represent timber framing with plaster panels. The appearance of the half-timber work was very easily obtained by first painting the surface a creamy white with a flat drying paint, and, when dry, the half-timbering was lined out with a sharp-pointed steel tool, and then filled in between the lines with black paint. The cusped bargeboards were cut out of thin oak and fixed under the soffit of the roof and gable. The roof consists of ordinary brown corrugated packing paper glued on top of the boarding, sized and painted red to imitate Bridgwater tiles. The ornamental ridge is formed with two sheets of narrow cardboard, glued at the upper portion and left clear at the lower portion, which act as flanges to lie each side, and are thus secured to the roof. The chimneys were made up with thin wood cut and shaped to fit the slope of the roof.

In arranging the interior work, the lower portion should be fitted up before the upper portion. Where the doll's house is arranged in two sections as above suggested this is not so necessary, as the upper section can have its floor formed to act as ceiling to the ground floor, so that when the upper section is removed, access can be gained to the rooms below; but, as may be noted, all the work must be brought to as near a finish as possible before fixing the roof, because it makes it rather difficult in fitting up if every

part is covered in, although access is obtained by means of the hinged doors at the back.

The chimney breasts were formed to project from the face by means of boxing out in thin wood, and then the grates and mantelpieces (cut out from advertisements) were stuck on the face. Hearths were formed with tile patterns in a similar manner, also the entrance-hall floor, the curbs to the hearths being made of moulded wood strips. The interior doors were formed of thin wood, panels imitated and drawn on paper with ink and coloured to represent graining. They were then pasted on each side of the wood. All are fitted with small white knobs. The front door was formed with panels, the top being fitted with coloured glass and fanlight.

The staircase is on the lines of the common house string staircase with half landing, and was made independently of thin cigar-box wood all glued up together, the balusters being formed with match sticks. The newels or posts are square with small turned knobs on the top.

The windows are small wooden frames rebated to receive glass, which was secured by gluing in narrow strips. Only the windows in the front of the house are hinged to open. The bay window was made separately and secured from the back of the house with screws. The roof is covered similar to the main roof. Architraves (narrow strip mouldings) were put round the interior and exterior of the doors and windows.

CHAPTER XVI

Dolls' Furniture, etc.

A Cradle.—The doll's cradle shown by Fig. 153 may be made of any material to hand. Hard wood is best, but any soft wood will do, and if stained and varnished would look very well. The two shaped sides are of $\frac{3}{8}$-in. material, cut to the sizes given in Fig. 154. Each end is made to

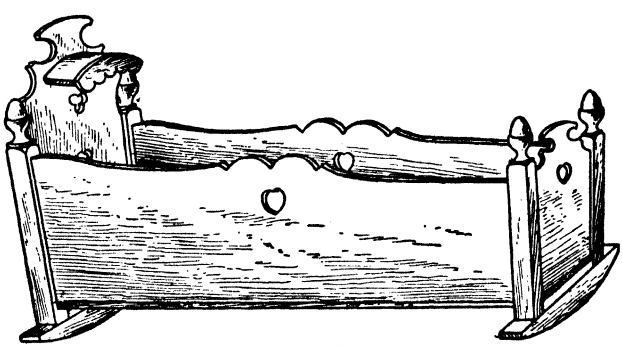


Fig. 153.—Doll's Cradle.

slope to $\frac{5}{8}$ in., and the top edges are rounded. The head of the cradle is shown by Figs. 157 and 158, and the foot by Figs. 155 and 156; these also are $\frac{3}{8}$ in. thick. The shade, or head shelter, is shown separately, with the full sizes, by Figs. 159 and 160; this should be nailed neatly in position.

The heart-shaped holes in the sides and ends are cut right through the material. The trefoil in the head is

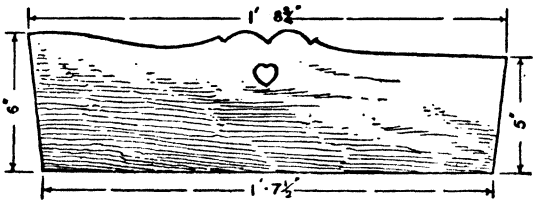
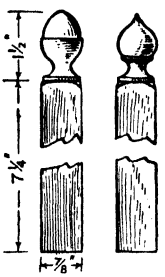
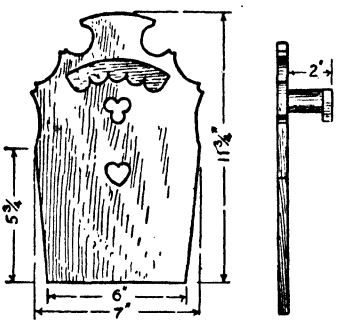


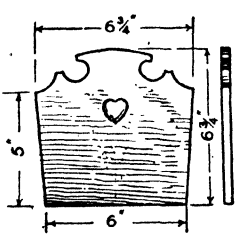
Fig. 154.—Side of Cradle.



Figs. 161 and 162.—Posts.



Figs. 157 and 158.—Head of Cradle.



Figs. 155 and 156.—Foot of Cradle.

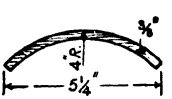


FIG. 159

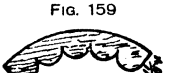


FIG. 160

Figs. 159 and 160.—Head Shade.

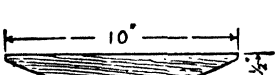


Fig. 163.—Rocker.

Fig. 164.—Cover of Cradle Bottom.

formed by boring three $\frac{5}{8}$-in. holes, which should first be set out in suitable positions.

Figs. 161 and 162 are alternative designs for the corner posts. The two head posts are longer than those at the foot, but all are $\frac{7}{8}$ in. square in section. The posts having

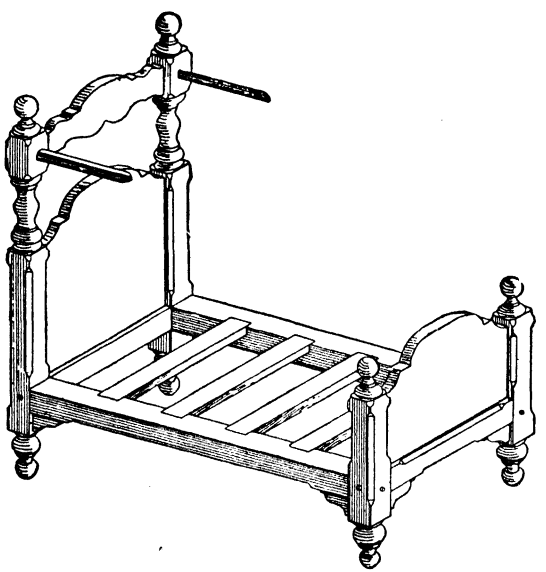
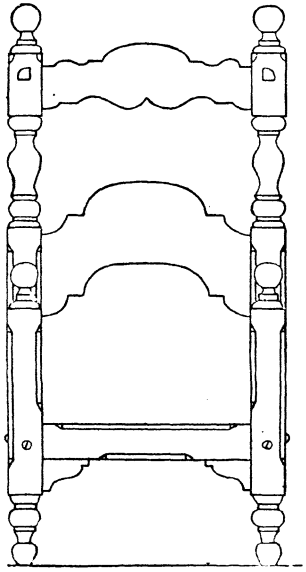


Fig. 165.—Doll's Bedstead.

been turned, the sides and ends are fixed to them with some fine wood screws, the posts being allowed to project 1 in. beyond the sides and ends at the bottom. It will make a stronger job if the posts are rebated $\frac{1}{8}$ in. deep to fit the other pieces. All screw-heads should be let down well below the surface, and plugs neatly fitted and glued in



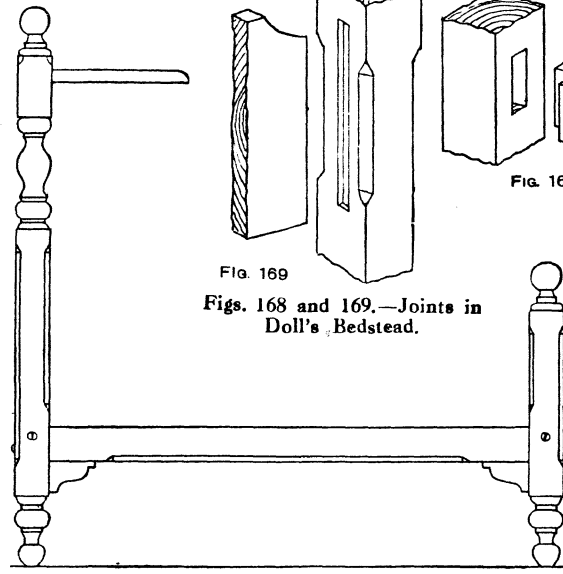


FIG. 169

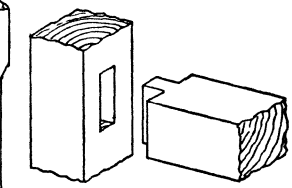


FIG. 168

Figs. 168 and 169.—Joints in Doll's Bedstead.

Figs. 166 and 167.—Two Elevations of Doll's Bedstead.

the holes, care being taken that the grain of the plugs runs the same way as that of the posts. Make the two oak rockers to the sizes given in Fig. 163, and $1\frac{1}{8}$ in. thick, and screw them to the ends of the posts.

The bottom of the cradle is of $\frac{3}{8}$-in. stuff 1 ft. 9 in. by $7\frac{1}{2}$ in., the outside edges being rounded. It is nailed

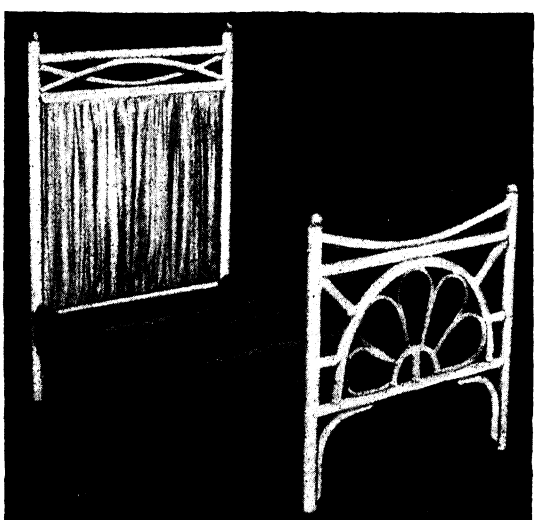


Fig. 170.—Doll's Bedstead in Cane.

in position, projecting $\frac{1}{4}$ in. all round beyond the sides and ends. A corner of the bottom is shown by Fig. 164, the cut-out piece being $\frac{3}{4}$ in. square.

A Wooden Bedstead. — Figs. 165 to 167 show the construction of a doll's bedstead. The size will vary according to requirements; any kind of wood may be used. The posts and rails can be jointed by stub tenons and

mortises as shown in Fig. 168, then glued together; they may also be further secured by round-headed screws. The head- and foot-boards may be housed into the posts a little distance as shown in Fig. 169.

A Cane Bedstead.—Fig. 170 is a photograph of a cane toy bedstead finished in white enamel, the drapery being of blue sateen. The bedstead is particularly strong

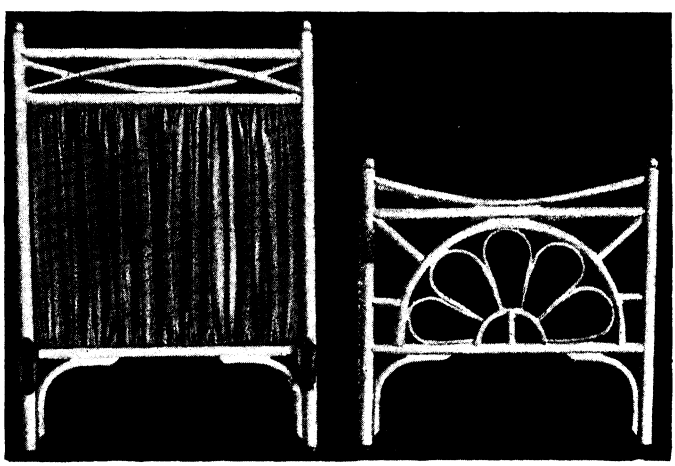


Fig. 171.—Head and Foot of Cane Bedstead.

and neat. As this is not meant to be a cheap toy, good work should be the rule; the better it is made, the more it will be worth.

The bedstead may be made to take down in the same way as a regular full-size one; but some people might prefer it in just three parts—the head, foot, and bottom—in which case the bottom frame and laths could be fixed together permanently. Fig. 171 gives a full view of the

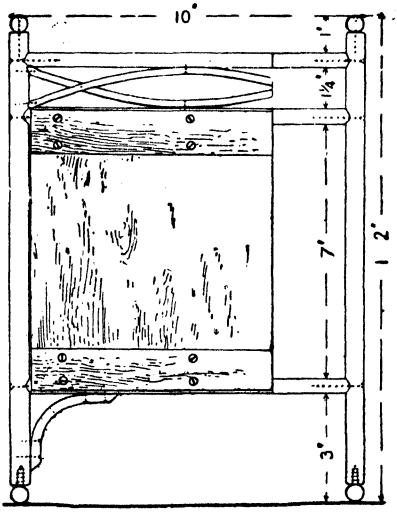


Fig. 172.—Details of Head Frame.

FIG. 174

FIG. 175

FIG. 177

Figs. 174 to 177.—Details of Joints.

FIG. 176

Fig. 178.—Part Section through Draped Panel.

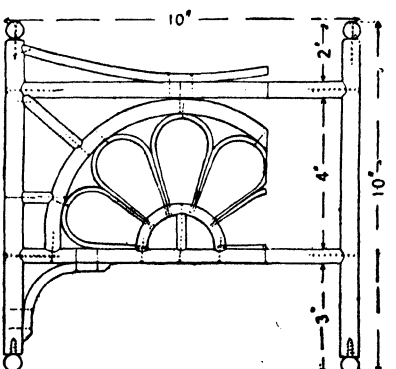


Fig. 173.—Details of Foot of Bedstead.

head and foot without the bottom. But the draped panel can be taken out, and even the drapery removed to clean, as occasion requires.

Full details of the construction and measurements of the head and foot parts are given in Figs. 172 and 173. The posts and rails are of ½-in. diameter beech dowel wood; but ⅜-in. stuff may be used for the upper rails.

The two plain frames should be put together first. The head frame consists of the two posts and three rails;

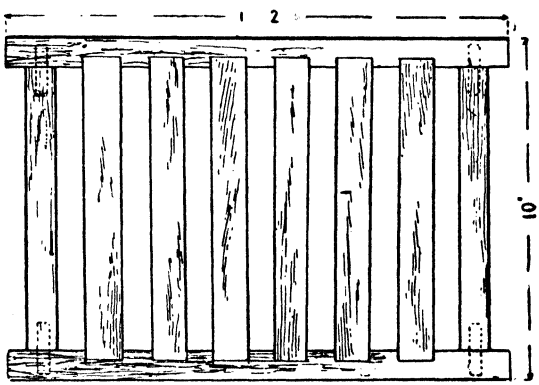


Fig. 179.—Plan of Bedstead Bottom.

and the foot, two posts and two rails. The ends of the rails must be shaped to fit the posts. This is done by cutting two corner pieces off to make it pointed, as in Fig. 174. Fig. 175 is a side view of the same. It is then an easy matter to work it to the shape shown by Fig. 176 with a half-round rasp, or it can be cut out with the small blade of a sharp penknife.

The joints are fixed with glue and a fine wire pin, as in Fig. 177. The glue should be hot and not too thick,

and the wood must be pierced with a fine bradawl for the pins. When the two frames are put together, they should be observed to see that they are quite square and free from twist. Then put aside in a dry, warm place to set. In the meantime the other parts, which are of cane, may be prepared.

The first piece to put in the foot frame is the large semicircular curve, then the two short pieces between it and the posts, and the corner pieces. Next, the small curve may be put in, with the vertical piece dividing the

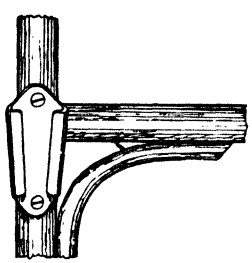


Fig. 180.—One of the Connecting Fittings.

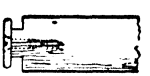


FIG. 182

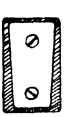


FIG. 181

FIG. 183

Figs. 181 to 183.—Details of Connecting Fitting.

space; then the magnet-shape pieces, the centre one first; and finally the two corner brackets and the top shallow curve. The head frame also may be done, and a panel of thin wood fitted, to be fixed in by means of two battens, with six small screws to each, as shown in Fig. 178. The piece of drapery for this is gathered on two threads and secured between the battens and panel.

On the top ends of the posts four small wood balls are fixed, and the lower ends are fitted with brass ball feet.

The bedstead bottom is shown by Fig. 179. The

frame is of 1¼-in. by ¾-in. birch, jointed together with wood dowels, the laths being of 1-in. by ¼-in. deal, let in level.

The connecting fittings were contrived from two pairs of cheap mirror movements, but only one part of each was available, as shown by Fig. 180. Into these a piece of sheet-brass is fitted, to drop in and out easily. They are to be fixed with screws on the ends of the bottom frame, as in Figs. 181 to 183, and the corners of the wood must be cut out a little to allow the parts to connect.

The head and foot parts of the bedstead should be neatly enamelled, three coats being applied. It is best to use enamel that is not too quick in drying, so that it can be worked out evenly with the brush.

Cane-work is a side line with which any handicraftsman would do well to get acquainted. It is not difficult in itself, and effects are frequently obtainable at the expense of a minimum of time and trouble; neither is the tool kit a costly item. Practically all that the worker in cane requires, in addition to a bench, is: small brace and boring bits; hand-frame fret-saw; small tenon-saw; small hammer; rat-tail rasp; pair of sectors; fine bradawls and pins; pocket knife; wood cutting-block for cutting and rasping the work on; and some pieces of cane and wood. The small outlay for these tools can be earned hundreds of times over by the use of them. Cane may readily be bent cold in the smaller sizes, but the larger ones need to be softened by steaming or by heating in the flame of a spirit lamp or bunsen burner, either of which accessories may be of the plainest and cheapest kind.

Chest of Drawers. — A miniature chest of drawers may be made as illustrated in Fig. 184. The feet are screwed on A, which is the bottom of the carcass. If desired, the ends might be continued to the floor, the front ornament being fitted in, and a small bead planted on to form a projection as at A; or turned feet might be used instead of those shown. B and B are pieces of wood 1 in. by

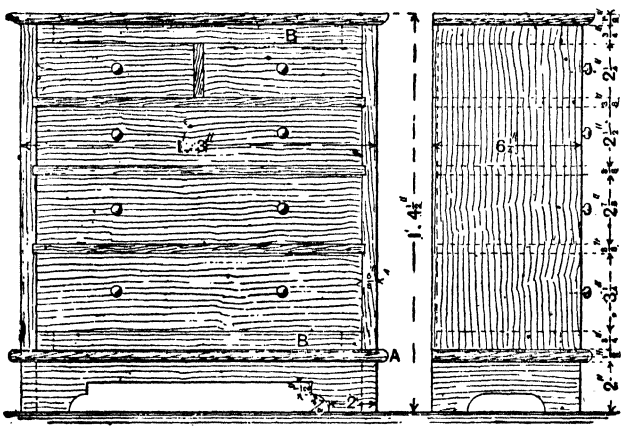


Fig. 184.—Doll's Chest of Drawers.

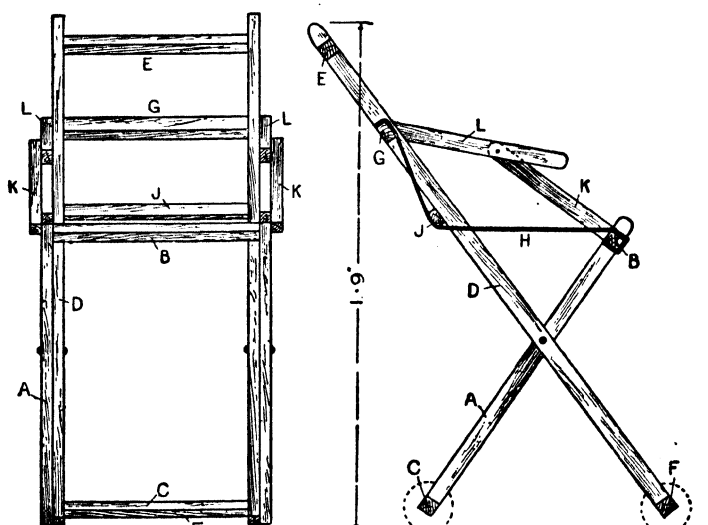
¾ in.; similar pieces go across the ends and so form three sides of an oblong as shown by dotted lines in Fig. 184. Small turned knobs are screwed on as indicated.

Folding Chairs. — Figs. 185 and 186 show how a folding chair for a doll was made from some waste pieces of wood varying in size from ⅜ in. by ¾ in. to ⅝ in. by 1¼ in. No joints are made; but the butting surfaces are given plenty of Scotch glue, and then nailed together.

The outer frame A, which is, of course, the one running

from the front of the seat to the back wheels, is 1 ft. 4½ in. long and 10 in. wide, joined together at the top and the bottom by two ¾-in. square pieces B and C.

As the pieces for the outsides are ⅜ in. by ¾ in., the length of these pieces is 9½ in. The inner frame D is 2 ft. long of ⅜-in. by ¾-in. stuff, also joined together by ¾-in. square



Figs. 185 and 186.—Front Elevation and Section of Folding Chair.

pieces E and F, but only 8½ in. long, as the frame is only 9½ in. wide, so as to put inside the other. The inner frame has another ¾-in. square piece G to take one end of the seat cloth H, and another piece J ⅜ in. square at the back of the seat. The arms are each made of two pieces K 7½ in. long, and two pieces L 8½ in. long, pivoted to the inner and outer frames and to each other. The inner and

outer frames are pivoted together, the first being 8½ in. from the bottom of the outer frame and 9¼ in. from the bottom of the inner frame.

The seat is made from blind material or anything similar, a piece 1 ft. 6 in. long and 7½ in. wide being suitable. It is fastened to the rail at the back, and then passed out-

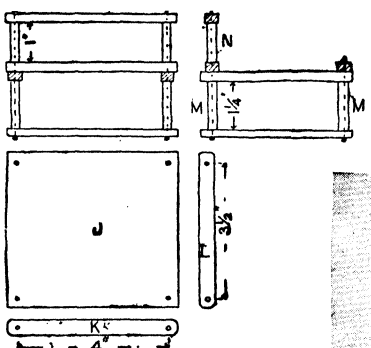


FIG. 188

Fig. 188.—Details of Chair of Swing.

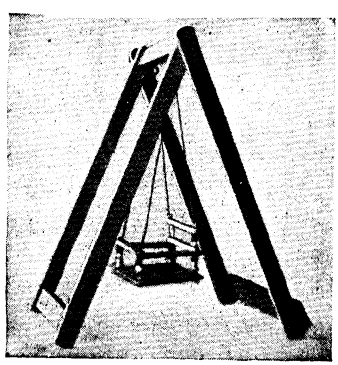


FIG. 187

Fig. 187.—Doll's Swing.

side the ⅜-in. square piece as shown. The height of the chair when opened out is 1 ft. 9 in., and the width 11½ in., excluding the wheels. The wheels are constructed of iron, the back ones being 3 in. in diameter and the front ones 2½ in.

Suggestions for other Furniture are given in Figs 149 to 151, p. 101.

A Swing.—The swing shown by Fig. 187 consists of a chair—made after the fashion of a child's swinging chair—suspended from a couple of frames pivoted together at the top, and so arranged as to close up, one within the other, for compact storage. A piece of string may be stretched from one of the lower cross-bars to the other—threaded through holes in each and knotted—to prevent the lower ends spreading too far apart.

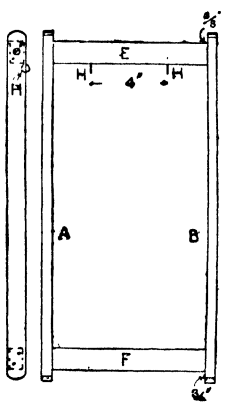


FIG. 189

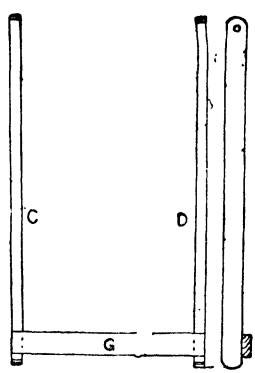


FIG. 190

Figs. 189 and 190.—Details of Swing Frame.

For the frames (see Figs. 189 and 190), four pieces of wood 18 in. long, 1 in. wide, and ½ in. thick will be required for the long sides of the frames, A, B, C, D, two pieces 8 in. long, 1⅛ in. wide, and ¾ in. thick for the cross-pieces E and F, and one piece 9 in. long, 1⅛ in. wide, and ⅜ in. thick for the cross-piece G. The frames are pivoted together at the top by a couple of 1½-in. screws. A couple of screw-eyes

H driven into the edge of the top cross-bar complete this part of the swing.

In making the chair (see Fig. 188), the wood used was $\frac{3}{16}$-in. three-ply, and the following pieces are required. For the bottom J, a piece $4\frac{1}{2}$ in. by 4 in., for the strips K, three pieces $4\frac{1}{2}$ in. by $\frac{3}{8}$ in., and two pieces L 4 in. by $\frac{3}{8}$ in. The distance pieces M (four required), $1\frac{1}{4}$ in. long, and N (two required), 1 in. long, may be of thin bamboo cane, as used for garden purposes, or large beads, which certainly look neater, may be used. Strong, durable string should be used in threading these parts together, or, better still, the chair might be threaded with wires with loops at the ends for attaching the strings. The upper end of each string is provided with a small S-hook for fixing to the screw-eyes in the top cross-bar.

CHAPTER XVII

Dolls' Go-Carts

A Double-Seat Cart. — Fig. 191 shows a double-seat cart. Small straps should be provided (same as in a baby car) to secure the dolls to the seats. Fig. 192 gives a side view of the frame of this cart, with the leading dimensions. The material is about $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. wide by $\frac{1}{2}$ in. thick after it has been planed up. There are no difficult joints to make, the stuff being simply screwed and nailed together. The two frames are kept 9 in. apart by the five rails, one at the back rest, two at the seat, and two at the lower ends. Fig. 193 shows the under side view of the seat rails at the corner A (Fig. 192). The handles are 3 ft. 6 in. long by $1\frac{3}{4}$ in. wide and $\frac{5}{8}$ in. thick. The wheels are cut from oak, elm, or ash, and are about 5 in. or 6 in. in diameter by 1 in. thick. They are mounted on short axles made from $\frac{3}{8}$-in. bolts. An enlarged sectional view is given in Fig. 194, where B represents the central upright, C the wheel disc, D the tubular collar ($\frac{1}{16}$ in. longer than the thickness of the wheel) slipped over the axle bolts. The ends of the tube are supported on the washers E, which prevent the bolt and wheel from jamming against the upright B.

A Single-Seat Cart.—A go-cart of different shape is shown by Figs. 195 and 196. Small rubber-tyred wheels are used for this cart. The axle is secured to the lower

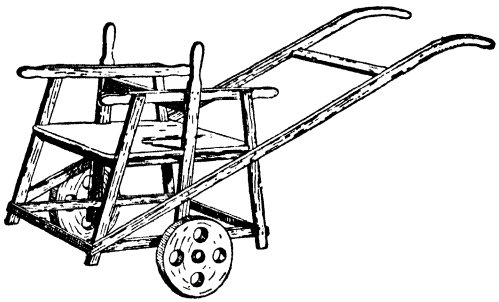


Fig. 191.—Double-seat Go-cart.

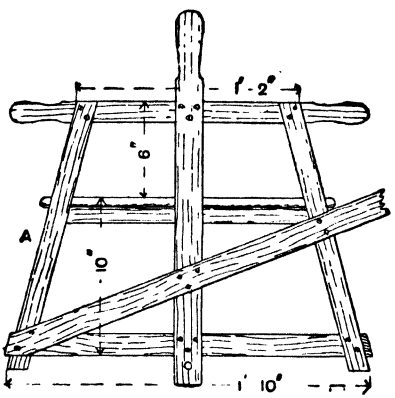


Fig. 192.—Side View of Frame of Double-seat Cart

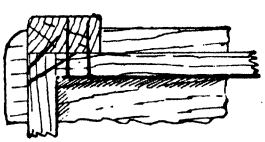


Fig. 193.—Details of Seat Bearers at A (Fig. 192)

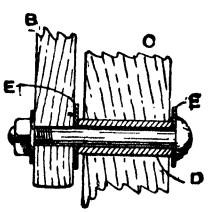


Fig. 194.—Enlarged View of Axle, etc.

rails with metal clips and wood screws as shown in the enlarged view (Fig. 197). The handles are about 2 ft. 9 in. long.

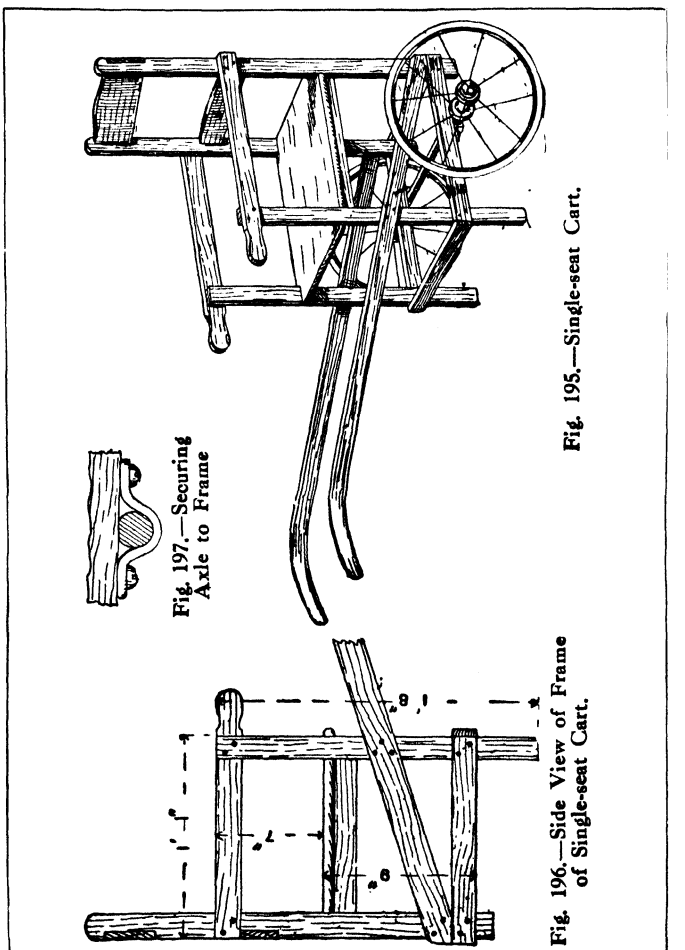


Fig. 195.—Single-seat Cart.

Fig. 196.—Side View of Frame of Single-seat Cart.

Fig. 197.—Securing Axle to Frame

CHAPTER XVIII

Wheelbarrows

A WHEELBARROW suitable for a small boy is shown in Figs. 198 to 201, which give the principal dimensions. The bottom, sides, and ends should be about $\frac{3}{4}$ in. thick;

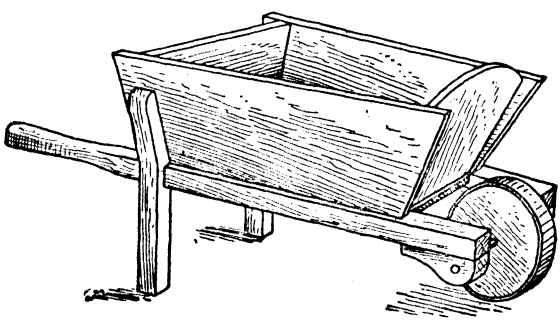


Fig. 198.—Wheelbarrow.

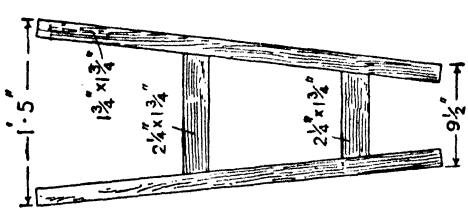
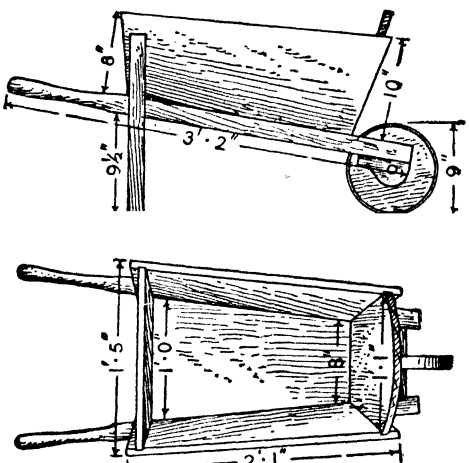


Fig. 201.—Framework of Barrow.

good white or red deal will be suitable. The stiles and rails of the bottom framework are best mortised and tenoned together; and they may be just stubbed

together, or the tenons of the rails may go right through the stiles. The most satisfactory job will be made by grooving the sides and ends together. The wheel is a wooden disc with a hoop-iron tyre, and its



Figs. 199 and 200.—Elevation and Plan of Wheelbarrow.

wooden axle has iron end pins which run in the wooden bearings shown. Iron wheels suitable for the purpose are obtainable cheaply, and the bearings could then be of sheet iron bent to shape, or, possibly, suitable castings or stampings could be bought.

CHAPTER XIX

Making Dolls' Heads.

A BOOK on toy-making must necessarily contain information on doll-making; but the reader must understand at the very outset that dolls cannot be satisfactorily made by the amateur or very small tradesman, the work requiring to be produced by systematised labour of the factory order and allowing, as a rule, of only a very fine margin of profit. Some idea of what doll-making demands in the way of skill and equipment may be gained from the following notes which, in substance, are due to "The Edison Monthly," published in New York, and apply particularly to the system of manufacture employed in a leading house in the American doll trade.

The heads are made in plaster moulds of various sizes, the ingredients being said to be a mixture of wheat paste and wax, that becomes very hard after being exposed to the air. The mixture is poured into the moulds, and these are stood aside long enough to permit a coating of the paste to harden on the inside, the rest of the solution being then poured out and the paste coating left to harden still further. On opening the moulds, the heads are transported in trays to the dipping-room, where they are plunged into soft pink wax and wheat paste, which requires several hours to dry, during which time the heads are hung up on high movable racks. As fast as

the pink coating becomes hard, the racks are moved across the room to the "art department," where two artists paint in the whites of the eyes, two more work on the eyebrows, two more spot in the blue pupils, while two more decorate the lips and nostrils. The heads are next coloured by means of air-brushes, one brush supplying the pink of their cheeks, another the brown hair, and another covering the entire head with a collodion enamel which dries very quickly and makes the colouring more or less permanent. The air-brush work requires almost as much skill as does the handwork. As soon as the enamel is dry, the heads are piled on a long table, where boys wrap them in tissue-paper and pack them into boxes to be shipped to various factories where the doll bodies are made. The making of the bodies, of the clothing, and of such specialities as eyes (fixed or movable), wigs, etc., etc., being all the subjects of special branches of the trade.

Making Heads for Rag Dolls.—The amateur and repairer may wish to make some heads suitable for use with rag dolls. Such work is quite possible, but it does not pay for the time and trouble; it is carried out in the following way:

Get a china head of the required size, where paint represents the hair. Wash the head in hot water, dry, and fill with a mixture of 3 parts plaster of Paris and 2 parts water. If the head has to be emptied after using, fill with wax instead of plaster. Smooth and square the edges of the bust before the filling sets too hard.

A mould must be prepared in two parts. A basin

can be used for this purpose, but a rough wooden box is better. Make it twice the length, width, and depth of the head, measurements being taken when it is lying face upwards. The bottom should be of ¾-in. stuff, and the sides of ½-in. Screw the pieces firmly together, half fill the box with fine silver sand, and pour in water until some remains on top, showing that the sand is saturated; then let it drain, leaving a perfectly level surface.

Lay the head face upwards in the centre, and press gently down until the lower half is buried in the sand, which will be disturbed by this performance; then pour in a little water, shake the box, and the sand will settle smoothly down. Brush sweet oil over the face, mix up sufficient plaster of Paris to fill the box, skim off all air-bubbles, and pour gently over the face and sand. Shake the box slightly to ensure the plaster getting into the corners of the mouth, nostrils, and other crevices; then finish filling the box. When set, smooth the top, undo the screws, lift the solid block from the sand, and the head will come with it. Next clear away every particle of sand from the head and the mould, and make a hole about ½ in. deep at each end and side, on the top of the mould, not too near the embedded head. These holes must be smooth, and should be made with a piece of wood shaped like a thimble, as the two halves of the mould will be held together after the manner of dowelled timber.

Now remove the sand from the bottom of the box, put the half-mould and head in place, screw on the sides, then brush sweet oil plentifully over the mould, particularly in the dowelled holes; but do not leave an

excess of oil on the surface. Mix up the plaster, fill the box, and, when set, level the top, undo the sides of the box, and separate the two halves of the mould by pulling straight—not slantingly, or the dowel pegs will break off in the sockets. Lift out the head, and allow the mould to dry. If a quantity of heads are needed, several moulds should be made.

Shellac knotting should next be brushed over each half of the mould, especially over the face, and, while it is drying, prepare the modelling composition. The wax must be cheap; common wax candles will do. Melt 4 oz. in a jar, remove the wicks, stir in 4 oz. of powdered whiting, and a little colouring to obtain a flesh tint. Either vermilionette or indian red can be used; the latter is cheaper, but must be cautiously added, as a piece of the size of a pea gives the desired shade to 1 lb. of composition.

Dissolve ½ oz. of white gum arabic in 1 pt. of cold water, fill the face half of the mould, and, after a minute or so, pour it out again. Plain water may be used, but the gum gives a body to it, and the mould receives an even layer of moisture. Serve the other half-mould in the same way. Then pour the hot modelling preparation in the face half, fix the back half over it, inserting the pins in the sockets, and shake well to distribute the contents equally over every part, making a hollow head. When the wax cannot be heard splashing inside, the mould can be put aside to cool. Then pull the mould apart, take out the head, cut away the lower part of the bust to allow it to fall over the doll's shoulders, trim the ridge

made where the halves join, and smooth with a rag dipped in turpentine.

The eyes, cheeks, lips, and hair should be painted with powdered colours mixed in hot wax, letting the jar stand in boiling water whilst applying the colour, which must be done carefully and quickly, as the wax dries almost immediately; but should an accident happen, let the wax dry, and then remove or lessen the quantity with a turpentine rag. The unused colouring can be kept, and remelted on a future occasion. Colours put on thus are permanent; but if the method is found to be too troublesome, mix powdered colour in white hard spirit varnish; it only requires shaking or stirring to be fit for use at any moment. It takes much longer to dry than wax, and is apt to crack off after a time.

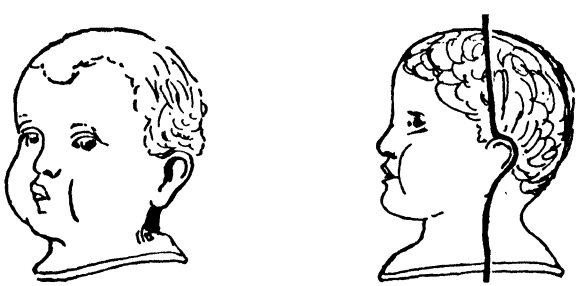
When hair and separate eyes are used, cut a hole in the back of the head and bore two eye-sockets. Coloured beads will do for eyes; or, if preferred, get some cheap eyes, put in position through the hole in the back of the head, and secure with a little melted composition. Cover the head hole with a circular piece of thick card, fixing with a mixture consisting of 2 parts of resin to 1 part of wax. If too brittle, owing to the quality of the resin, add a little more wax. Make a small hole in the centre of the card, form a tassel with coarse, dry sheep's wool or tow, force the top into the hole, arrange over the head, cut a fringe, and glue the back hair on the card. If the fringe is stuck down, the resin mixture must be used.

Making Moulds for Dolls' Heads.—The following notes will be of value to readers who wish to experiment

for themselves in the production of moulded heads. The Germans have in the past done a huge business in supplying dolls' heads, but the modelling was not up to the highest standard, and it is believed that England and America produce the more realistic representations of the child's face, sold under the title of "character" dolls (see Fig. 202). Intending makers should spare no expense in obtaining the very best in the modelled features, the only way to do which is to find and employ an artist who is clever in this particular direction. In instructing him, it should be pointed out that the original model should be so designed that it can be moulded in a split mould, and as a rule it will be found that the parting line of such a mould will usually have to follow the line indicated in Fig. 203. In any case, the artist should model the features so that the common doll-like face is avoided. Another point is the hair and the eyes. In some cases real hair is used, in which case the mop of hair can be made to cover a big hole in the back of the head (near the top), and questions of coring are altered. Eyes may be painted on, or glass eyes may be inserted during or after the moulding.

The method of running the material, and the characteristics of its setting or hardening when moulded, must be considered before designing the mould. If the material (a wax, for example) is such as will "chill" on the outside while the inside remains in a molten state, then the question of coring out a solid head (that is, one without real hair, as illustrated in Fig. 202) is simplified. A rough experimental mould of any bottle-shaped profile

may be made to find out the best method of pouring and mixing, the consistency of the mixture, the mass of the mould, and the question of the application of heat or the cooling of the mould to provide for the chilling. For instance, if wax were used in a mould such as is indicated in Figs. 206 and 207, the two halves of the mould would be placed together and the hot wax poured in. The mould may be slightly hot to ensure perfect contact



Figs. 202 and 203.—Cast of moulded "Character" Doll's Head, showing Parting Line.

as well as the absence of chilling, and consequent cracks as the material is introduced. The mould may then be cooled down on the outside in the air or by dipping in cold water; before the interior wax sets, it may be poured out, so leaving a shell. For manufacturing purposes a reproduction of the moulds is essential to enable large quantities to be cheaply produced, and it is obvious that the "job would be killed" by having to employ an artist or skilled craftsman to cut out the numerous duplicate moulds required.

The artist's original sample may be modelled in clay, and from this a gelatine matrix (half mould) of each side must be cast in a suitable pair of boxes with gelatine; there is no need for the parting line being made to fit the proper parting line of the final cast, as gelatine will give and resume its shape when slightly undercut. Indeed, it would be possible to cast it without a parting line at all, if the original model were strong enough to stand pulling out. This was done in the case of a copy taken off a good design of a foreign-made doll's head. The

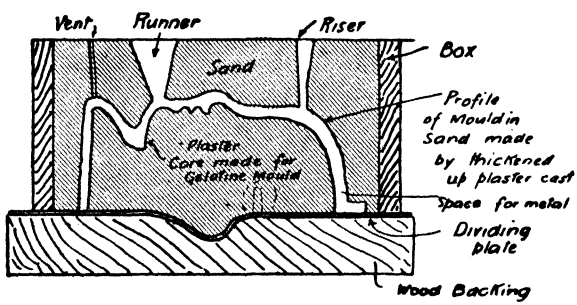


Fig. 204.—Type-metal Mould for Doll's Head: Obverse Mould

half gelatine matrices are trimmed down to the proper parting line so that the two fit on the dividing plate previously made. When finished and set, the gelatine mould or matrix may be employed to obtain several very fine sand plaster casts.

The plaster casts are used then as a core for the type-metal moulds. First, one of the plaster casts may be thickened up all over as equally as possible, the identity of the parting line being preserved in any convenient manner

—for example, by drilling holes in it on the line and inserting and cementing in suitable fine metal pegs or pins. So long as the plaster casting being dealt with is thickened up sufficiently, its exact exterior shape does not matter. This thickening can be accomplished by pouring over it successive coats of plaster ; afterwards the thickened-up pattern can be moulded in sand, each half separately, on the metal dividing plate previously made to suit the particular model. Figs. 204 and 205 show this mould

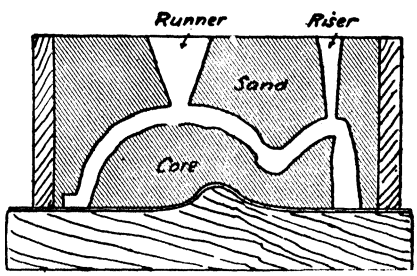


Fig. 205.—Type-metal Mould for Doll's Head : Reverse Mould.

ready made and with a gate (runner) and riser all formed. The pattern should be stuck to the dividing plate, so that it remains in place on the plate when the plate is lifted off the sand mould, and its position marked. The half mould of the desired shape is then placed in its proper place and fixed. For this it may be plaster cemented on a peg, fixed in the dividing plate. The two parts of the mould when fitted up are then as shown in Figs. 204 and 205, and the metal is then ready to run. Both parts are similarly treated, and when being joined together the two halves can be registered by inserting a

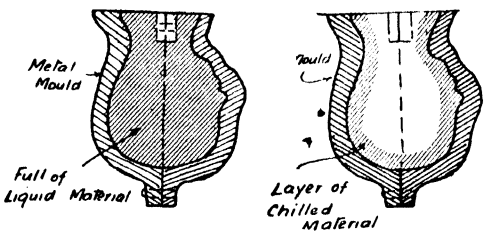
spare solid plaster cast of the head, and all clamps and dowels arranged for. Any places which do not meet properly can be tooled with a scraper.

In this way, a comparatively thin two-part mould, of which the thinness or thickness can be easily regulated to requirements by the process of thickening up, is obtained; and into this mould the plaster or other material can be run with ease, as illustrated in Figs. 206 and 207. Should it be necessary to have a solid core—the pouring-out method not being applicable—such a core may be in wax cast in a type-metal mould. When cast off, the mould is split and the casting set up to dry. The wax core can be melted out by warming, care being taken to warm from the orifice end first. All the wax is reclaimed and used over again.

To save making type-metal moulds, electrotyping can be resorted to, the plaster cast or the original model being sent to a firm of electrotypers, and two half moulds are made in copper or nickel by the electro-depositing system. When received from the electrotypers the shells, which should be reasonably thick, can be strengthened by soldering on protecting strips—backing up with type metal in the same way as an electrotyped copy of a printing block—and arranged to fit and clamp together for casting purposes. This is a good process but, of course, cannot be very well done without proper apparatus. Electrotyping is not an expensive process.

In many cases dolls' heads are made by coating a papier-mâché core (which is in turn cast in a suitable mould) with wax. This may be done in a split mould—

the thinner electrotyped mould being the more suitable because it can be quickly cooled and heated. Eyes can, of course, be inserted and fixed during this process.



Figs. 206 and 207.—Chilled System of Casting Before and After Casting.

For the chilled system of moulding dolls' heads, what is really required is a composition that can be hardened on the skin in a reasonable time by heat or making cold; the material must cast with ease and with a fine surface; and further, it is desirable that it shall be unbreakable.

CHAPTER XX

The Production of Tin-plate Toys

THE manufacture of tin-plate toys has during recent years been developed enormously, and even in Germany this branch of toy work has been transferred from the small home-worker to the factory. In Nuremberg, there are several very large firms who specialise in tin-plate toys, and who can successfully compete with the small maker in the cheapest kind of goods, that is, the penny lines. The secret of the industry is the use of machinery and large quantities. Unless, therefore, the toy-maker has the command of power presses and sufficient capital to make an outlay of, say, £20 to £30 on the press *tools* for one particular penny toy, and has a sufficient range of these toys to enable the dies of one toy to be employed in another toy of different external design, then the enterprise had best be left alone. Tin-plate toys are finished in one of two ways. They may be hand-enamelled, transfers being applied for various ornaments, lettering and trade marks, or the tin may be printed in colours before the article is pressed and made up. The hand-enamelled toys are, of course, more expensive; but the system is necessary for boats and other floating models, for those models that hold and pump water, and also for certain parts of some steam-engines, although printing and hand-enamelling are often combined in one toy.

In place of hand-enamelling, oxidised brass is often used for steam boilers, the joints being previously soldered to make them steamtight. These oxidised portions are then built into printed parts, or else into parts of coated or surface iron or steel.

Printed tin toys cannot be soldered together: therefore the parts are attached to each other by lugs, which engage slots, and are then bent over by the assemblers. Needless to say, the tools which punch these slots and cut out the other parts with the lugs or ears must be very accurately made and registered. In cases where solder must be used, as in some of the best made tin-plate wagons and locomotives, a soldered-up base is employed, and the ornamentations in printed tin are attached afterwards. In making model wagons a system of standardisation was adopted by Mr. H. Greenly which reduced the first cost of the tools enormously. All the lower parts and sides of wagons (and roofs of covered wagons) were made to one set of overall dimensions. The designs of various railway companies' vehicles, L. & N.W.R, M.R, L.B. & S.C.R, G.N.R, G.W.R, etc., were then made to suit these press tools, and in case of any additional part required in one particular wagon, slots were arranged for. The base of the wagon, therefore, had more slots than were apparently needed for one design of wagon, but all slots came into use when wagons covering the whole series were built up. As far as possible, right and left-handed sides and ends were eliminated.

Fig. 208 shows a sample of the already printed plate (in the flat) for a model L. & N.W.R. covered meat van.

The plate includes a side and end, and two of such plates are required for one wagon, both ends and sides being made to the same design ; and for 500 wagons a run on the printing machine of 1,000 would be required. For toys that have different or " handed " sides two designs are necessary, and the run equals the number of toys required. The system of printing is lithographic, either directly from the stone or by the offset method. White is the most difficult colour to obtain in any degree of purity,

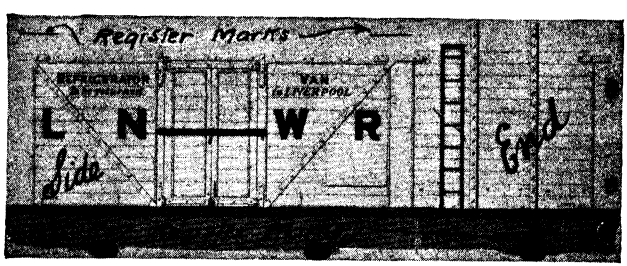


Fig. 208.—Sample of Printed Tin-plate in the Flat.

and double printing may be required. In the printing the design should contain various register marks to enable the press-tool operator to provide guides. The tools are made to suit these marks, paper proofs being obtained from the lithographer. Best work is varnished with a colourless varnish after the model is built up.

A toy maker who has one or two first-class designs, and knows that he can dispose of the goods, can arrange with some tin-box printer and presser to do all the machine work, and can assemble the parts with girl and boy labour. This is the only practical scheme for the small manu-

facturer, and even this eliminates the amateur with a small shop and no other trained operatives but himself.

Should a new tin-plate printed toy be required to be put out to a firm of tin-plate printing and press workers, a hand-made cardboard or tin-plate sample showing exactly the construction contemplated should be provided. Further, an accurate "developed" drawing of each part, coloured in the proper colours, should be prepared; this drawing should show and allow for all bends, lugs and slots. Where the tin must be printed both sides, a duplicate view of the part will be required. In any case, it should be indicated on the drawing whether the reverse side of the parts are to be left bright or to be coated, and if coated the colour should be stated.

CHAPTER XXI

Casting Toys in Metal

WHILE light iron and brass castings are largely used in model and toy making, the labour of cleaning up and machining them, together with the intrinsic value of the metal in the case of brass, often places such castings quite out of the question. Moreover, the intricate forms required all tend to increase the cost because of the expenses in patterns, castings, machining and assembling. Machining is a heavy item and may entail the preparation of special and costly jigs, and as all toys must be cheaply produced, the maker looks round for something which will reduce the cost of the metal portions of the article he intends to produce. Metal stampings provide a way out, but then the machinery required to operate the dies are costly, the tools complicated, and the numbers required to make the article relatively cheap are often enormous. Furthermore, stampings do not always give the required effect of solidity.

Consideration may, therefore, be given to the process of type-metal casting or "die-casting" as it is called. For small parts requiring intricate detail, type metal or any of the lead-tin-antimony alloys will satisfy most requirements, and a comparison of the costs may be taken in the case of a small wheel for a model gun. In brass, the six wheel castings, which weighed 1 lb., cost 1s. 8d.

and required two and a half hours to clean them up, bore and true them. A mould for die-casting was made at a cost in time and material of about £1 10s., and it was found that the first five wheels cost for metal 5½d., and half an hour for casting and quarter of an hour for cleaning up. Taking arbitrary figures for wages, the six brass wheels cost 2s. 3d., while the five type-metal wheels did not cost more than 8d. and were infinitely better than the brass wheels in the matter of detail and in finish. As four wheels per article were required, with respective costs of 2½d. for type-metal and 9d. for brass, the retail selling price of the article was reduced from 5s. to 3s. 6d. Another point in favour of the type-metal castings was the fact that they could be made on the premises, there being no need to wait on the conveniences of the foundry man and railway company.

In all type-metal castings where a large number of articles are required metal moulds are used. For first sample and experimental purposes the dies need not in every case be prepared, but the parts can be made in the ordinary way out of brass. Recently, the writer had to get ready six preliminary samples of a new pattern of wooden toy having metal parts, which parts it was intended to produce by die-casting. To save the labour of making up by hand six brass sets of parts, only one set was made (really a set of brass patterns) and six copies made in type metal by casting in sand moulds (see Figs. 209 and 210). The proper moulding sand not being obtainable at the moment, a clean mould was made by mixing ordinary fine sand with damp fireclay, the mould

Fig. 209.—Brass Pattern.

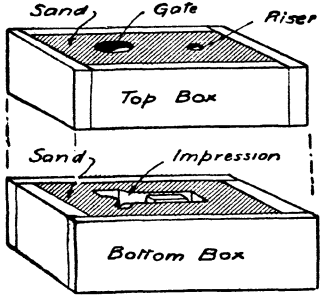


Fig. 210.—Moulding Patterns in Sand.

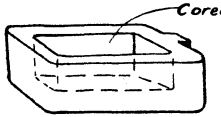


Fig. 212.—Simple Die-cast Object.

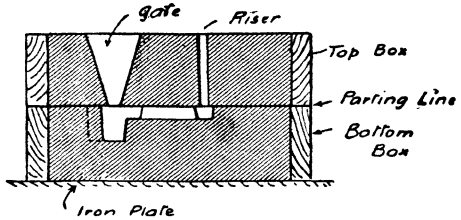


Fig. 211.—Section of Mould Fig. 210.

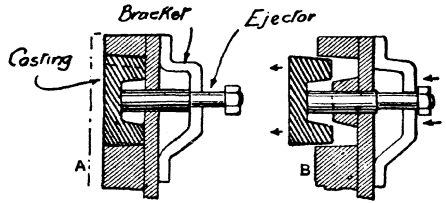
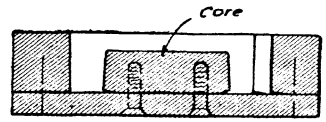
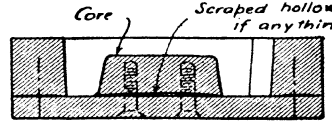


Fig. 215.—Use of Ejector Rod.





Figs. 213 and 214.—Bad and Good Built-up Moulds.

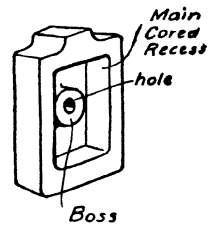


Fig. 216.—Casting with Cored Box.

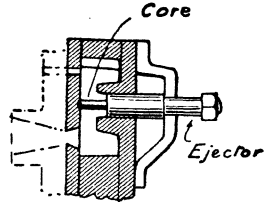


Fig. 217.—Combined Ejector and Core Spindle.

being dried before use. The brass patterns were arranged with the "draw" all the one way, so that the mould came entirely in the bottom box, a portion of the clay and sand mixture in rough boxes, a gate and a riser being used on top to introduce the molten metal, as illustrated in Fig. 211. The metal used in die-casting may vary in hardness. Where straps or other clips which must fit over wooden parts with a certain amount of grip, a greater proportion of lead may be employed, say ten of lead to one of antimony. For objects which would be better harder, the proportion of antimony may be increased, and a mixture of five of lead to one of antimony employed. Too much antimony will give a very brittle alloy. Standard type metal was found to be not too hard for ordinary purposes. To soften it a little pure lead was added. In mixing the alloy, the antimony should be melted separately in a forge, then added to the molten lead, antimony itself requiring a much greater heat than lead, viz. 810° F. against 600° F. for lead. Tin and lead alloys are very good, but tin being an expensive metal for most toy purposes the lead-antimony alloys will be found to be quite satisfactory.

While these notes will tend to reduce the time taken in obtaining satisfactory castings, a certain amount of experience—which one always pays for—will be necessary in every new job. In casting, it is important that the metal should be run sufficiently hot, and equally important that the mould should contain just the right mass compared with the character and weight of the object being made, so that it just keeps hot enough to ensure a sound

casting. Perfect workmanship is necessary in the mould, especially in all joints, as the metal will find the slightest crevice. For instance, if the object, such as shown in Fig. 212, is being cast in a built-up mould, care must be taken to see that there is no crevice in the bottom joint of the mould, otherwise the casting may be keyed in. Ample draw must be given to the centre core, otherwise the metal in shrinking will grip the core just as a wheel tyre shrinks itself tightly on to a wheel centre. Figs. 213 and 214 show a bad and a good mould respectively. In the faulty one (Fig. 213) the pieces forming the core and the outer ring are not fitted perfectly to the base plate of the mould, and the sides are not sufficiently inclined. As the metal shrinks towards the centre, the core piece requires the greater inclination, and if this is sufficient (and there is no undercutting or keying in, as shown in Fig. 213) the casting should drop out. In fitting such pieces to a base, scraped fits should be made, and the tendency in scraping up should be to make the pieces hollow, as shown exaggerated in Fig. 214, so that the pieces bear hard all round the visible portion of the joint. Should the casting be rather deep it will not fall out very readily; this will necessitate a piece termed an ejector, and in the casting in question, especially if it is required in the harder kind of metal, this might be placed directly under the centre. It is made by drilling in the core a smooth hole of suitable diameter according to the size of the casting, and fitting the hole with a rod, which may be guided on the outside by a looped strap or bracket so that its movement is limited. The action of the ejector

is shown at A and B, Fig. 215, the former showing how the shoulder on the ejector rod, by engaging the strap or bracket, puts the rod in its correct position for casting. If its movement were not limited in this way or in a similar manner, and were set a little too low, it would cast a boss on the object as indicated in Fig. 216. Possibly such a boss may be required, and also a hole in this boss as shown. This is easily provided for by making the ejector rod shorter and giving it a spigot, which will core out the required hole. Fig. 217 is a section of a suitable mould with the combined core and ejector rod in place and ready for pouring the metal. The hole forming the small boss will require counterboring at the top with a taper reamer to give the casting the required draw, as well as to improve the appearance.

Accurate holes and undercuttings can in the die-casting process be introduced in almost any position by the addition of sliding cores. Should a casting of the general shape, shown in Fig. 216, require two holes in it at A, B (Fig. 218), this can be arranged for by a draw core made after the manner indicated in Figs. 219 and 220. In this case, to quicken the process of casting, the couple of core spindles necessary may be withdrawn by one pull of the pliers, a bar connecting the two spindles outside the bracket guide, the latter also providing stops for limiting the outward movement. The precise design of the outside gear controlling these sliding cores is not important so long as they will stand rough usage and do not jamb. In a deep hole it might possibly be better to have the

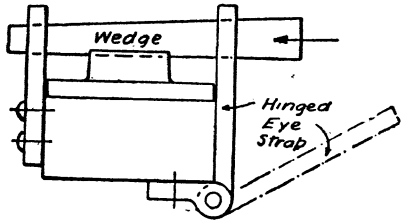


Fig. 224.—Wedge for Clamping Mould.

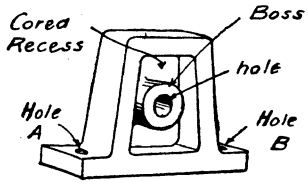


Fig. 218.—Casting with Transverse Holes.

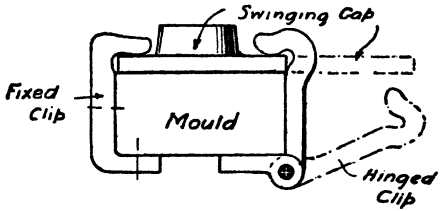


Fig. 223.—Hinged Clip for Clamping Mould.

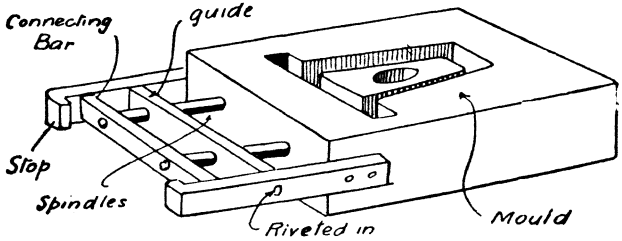


Fig. 219.—Mould with Draw Cores.

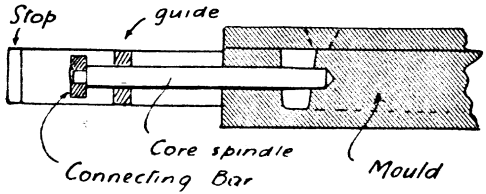
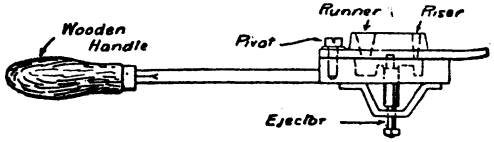
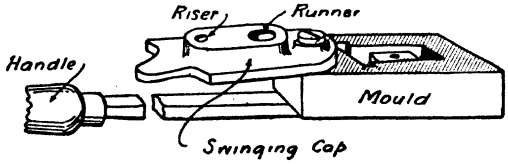


Fig. 220.—Section of Mould showing Draw-core Spindle.





Figs. 221 and 222.—Mould with Swinging Cap, closed and open.

core spindles separate, so that they may be twisted, the metal having a tendency, in cooling and shrinking, to grip all cores. The spindles could be made slightly taper to assist the withdrawal. The sectional drawing shows one of the core spindles in position. When cast, the spindles must, of course, be pulled out before the casting can be ejected.

Before describing the various methods of arranging for the splitting of the moulds after casting and shearing off the gates, etc., the methods adopted of coring hollow figures like toy soldiers, birds, etc., may be mentioned. Needless to say, it would be quite impossible, at the price these soldiers, etc., are produced, to prepare cores in sand or to arrange for other collapsible metal cores. The moulds are made in much the same way as they would be if the object were to be solid; and the operator, after pouring in the metal, allows it to remain for a short time and then tips it out again. The outer skin of the casting becomes chilled by the mould and solidifies; it remains in the mould and provides the necessary thin hollow casting. The workman by experience knows, by the appearance of the metal, etc., just when to eject the superfluous metal.

For castings in which an entirely plain flat surface on the parting line is required, as illustrated in Figs. 216 and 217, a sliding cap may be provided, as shown in Figs. 221 and 222 on p. 147. The bottom (main) portion of the mould may be fitted with a wooden handle, and the cap may be a piece of metal a dead fit on the upper surface mould. This cap should be pivoted at one end

so that by sliding the cap on the pivot, that is, by giving it a horizontal rotating movement as shown in Fig. 222, both the runner and riser are shorn off, leaving a completely finished casting in the mould, ready to be ejected. Where a combined core and ejector is used, as already illustrated and as shown in Fig. 221, the ejector pin must be first withdrawn a little so that the core peg clears the hole in the cap and allows the latter to swing open. The cap should be provided with a rather deep runner or gate, as this gives a greater head of metal and ensures a sounder casting. The next point to be considered is the clamping down of the cap. The molten metal will travel along very minute crevices, especially those, it might seem, where it is not intended that the metal should flow. For this reason all working joints should be made to fit as closely as possible. The difficulties of obtaining and maintaining perfect joints has seriously affected the method of die-casting with the metal under pressure. The advantages of pumping the molten metal into the mould are obvious, but the metal finds the most minute crevices, and the necessity of preventing the spurting out through parting joints and through the joints of sliding cores, all of which may be good when the mould is new, had led makers of die-casting machines to abandon the forced-feed system and to rely only on a head (a few feet) of metal. The clamps for holding down the cap of the mould should, therefore, be powerful. Screw clamps are very good, but it must be remembered that in casting the mould and all its fittings are very hot, and the moving parts have to be handled by pliers or other tools.

For the mould under consideration, four methods are suggested. In Fig. 223 the swinging cap fits under a permanent clip on one side, this clip being included so that it grips the cap firmly in a vertical direction as it slides under it. On the opposite side a hinged clip is employed, which grips in the same way but folds down when it is desired to swing open the cap. In the next illustration (Fig. 224) a wedge is employed, on the side the swinging cap opens a hinged eye being used. This method ensures a firm clamping down of the cap, and the wedge can be easily handled and knocked home and out with a pair of heavy pliers. A swinging strap may be employed as shown in Fig. 225, and if thought necessary this strap may be fitted with a cam gear as shown in Fig. 226. This cam could be made as part of the hinge underneath if desired.

Two-piece moulds in which there is an equal amount of metal are often required. Taking the case of a simple object such as is shown in Fig. 228, this may be moulded in a two-piece mould. one piece (the major portion, if there is any difference in size) being attached to a handle and the cap or movable piece being maintained in position by dowel pins, and clamped with a loose ring, as in Fig. 227. When cast, the ring is removed and the cap loosened by tapping the projecting horn at the top and the bottom, and, to obtain sound castings, the runner should be fairly deep and well "V-eed," and the mould and metal should be hot. If any difficulty is experienced with venting the bottom flange of the mould, an air lock would, of course, prevent a full casting, and this failure may be mitigated by drilling

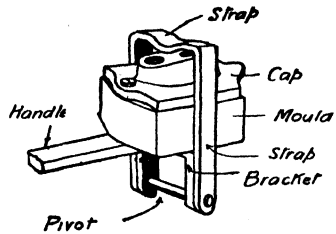


Fig. 225.—Swing Strap for Clamping Mould.

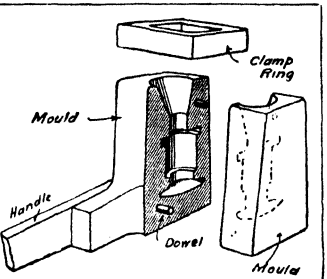


Fig. 227.—Split Mould (*see* Fig. 228).

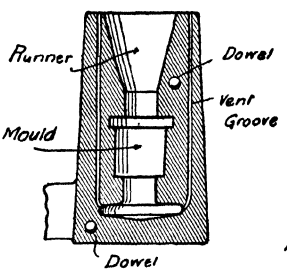


Fig. 229.—Venting Split Mould without Riser.

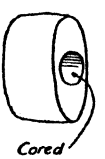


Fig. 231.—Simple Cored Casting.

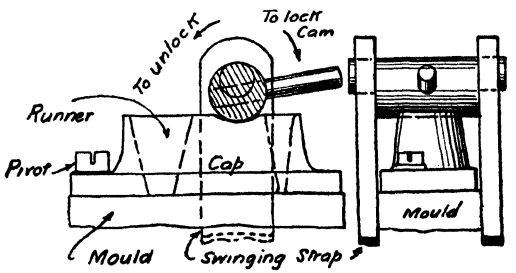


Fig. 226.—Cam-action Clamp for Mould.

Fig. 228.—Simple Round Casting.

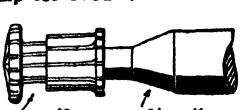


Fig. 230.—Milling Cutter for making Split Mould (*see* Fig. 228).

down exactly on the parting line or carefully filing a $\frac{1}{8}$ in. groove in the cap, as shown in Fig. 229; or the two methods may be combined as shown. However, vents should be avoided if possible. To make moulds of this sort, a milling cutter (Fig. 230) of exactly the same profile as the model to be cast is first made. A hole is bored in the two pieces of metal which have been faced up and clamped together, the size of this hole being a little smaller than the diameter as to the smallest part of the casting. The conical runner can then be made, and following this the cutter running in the lathe is clamped between the two blocks until the faces meet. In some cases two milling cutters may have to be made, one for roughing out and the other for finishing. Where an irregular shape is required, the mould must be prepared by drilling, shipping and filing, the form of the cavity being compared with the required one, by impressing a piece of wax into the cavity. Moulds for modelled figures may be made by first making a plaster or hard wax cast off each half, these casts being used as patterns, and brass or iron castings being obtained from them. The metal castings are then cleaned up by hand, engraved where necessary, and then faced up at the parting line. An alternative method is to build up the mould by drilling, cutting and piercing layers of metal to the correct shape, allowing the necessary draw in each case. The parts can then be carefully riveted or silver-soldered together, and finally cleaned up ready for the casting process. Where a cored object (Fig. 231) is required, its parting line can be arranged, as in an ordinary engineering pattern for casting purposes, at the centre

line of the core. Of course, a metal core is used and such core must have "draw" (that is, be tapered) so that it may be more easily knocked free of the castings. A mould with such a core is shown in Fig. 232. After

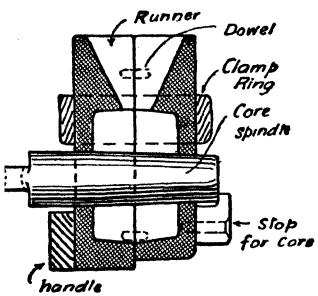


Fig. 232.—Split Mould with Pull-out Tapered Core.

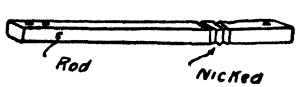


Fig. 237.—Nicked Rod.

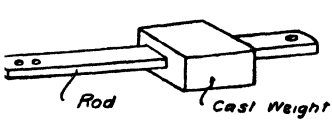


Fig. 235.—Lever with Cast Weight.

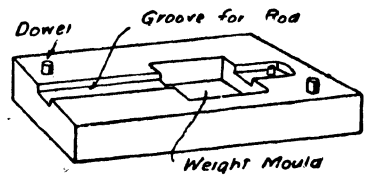
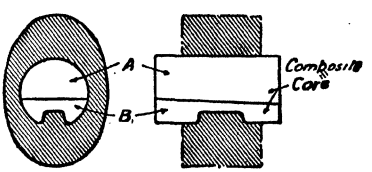
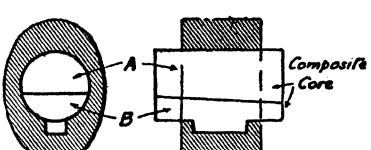


Fig. 236.—Mould for Weight (*see* Fig. 235).





Figs. 233 and 234.—Examples of Two-piece Cores.

casting, the core should be removed before the mould is parted, as then it can be forcibly removed without any danger of damaging the casting. If the core must be undercut, or of such a form that it cannot be pushed out of the mould in the ordinary way, then a two-piece core may be used; two examples of this are shown in Figs. 233 and 234, the pieces A, A being knocked out first, the pieces

B, B being lifted over the indentation or lug formed in the casting. Where parts of the toy have to do work entailing considerable wear and tear or withstand heavy strains, it is customary to cast into the object stronger and harder metals. Take, for example, the weighted lever shown in Fig. 235. Here the lever itself is a brass or steel rod, previously drilled and cut off to length. The bottom half of the mould (Fig. 236) is arranged to receive the rod, one end at least being allowed to project to facilitate the removal of the casting and some means, such as shown, being provided to ensure the weight being cast on in the proper place. Before laying the rod in place, the part around which the type-metal object is cast should be cleaned and nicked (Fig. 237) with a chisel or coarse file to form a key and prevent the casting moving. In addition to this nicking or keying, the rod may be "tinned" with solder, and then the metal will more firmly adhere to the rod. Spindles and pivots may be introduced in the same way. In most cases the bearing for such spindles and pivots will be found quite satisfactory and wear very well indeed if arranged to run in the white metal itself. There is no need to introduce hard-metal bushes or bearing plates so long as the pivot bearing has an ample bearing. In this matter, the length of the bearing is the most important point.

Fine spokes can be cast into white-metal wheel bosses and tyres by the above method, the mould being a composite one with one gate or runner for the tyre and one for the wheel boss, the latter at the same time being cored for the axle.

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